DOCUMENT RESUME

ED 052 945

SE 011 182

AUTHOR	Simons, Eugene M., Ed.
TITLE	Science Policy Reviews, Volume 4 Number 1.
INSTITUTION	Battelle Memorial Inst., Columbus, Ohio.
PUB DATE	71
NOTE	103p.
EDRS PRICE	EDRS Price MF-$0.65 HC-$6.58
DESCRIPTORS	*Annotated Bibliographies, Environment, Literature Reviews, *Policy, *Policy Formation, Pollution, Resource Materials, *Sciences, *Technology, World Affairs

ABSTRACT

This is the first issue of the quarterly publication, Science Policy Reviews, a modification of the former publication, Science Policy Bulletin. This new publication presents reviews, highlights, and annotated bibliographic references from the current national and international literature in the area of science and public policy. For brevity, the word "Science" in the title of the Reviews is used to denote engineering and technology as well as science. Science Policy Reviews is intended for individuals and organizations engaged in studying, formulating, or implementing public policy relating to science and its applications. The literature reported in the Reviews includes books, reports, and periodical articles. The regularly screened periodicals are listed on the inside back cover. The focus of the literature reported is on matters of broad public policy; literature of a highly technical and narrowly specialized nature is not included. Included in this issue are 424 entries, each of which has a short, descriptive annotation. Entries are not placed into topical categories, as was the practice in the previous publication; thus the subjects considered are not restricted to particular topic areas. Most entries in this issue relate to the United States science policies, but literature pertaining to science policy in several other countries is included. (Author/PR)

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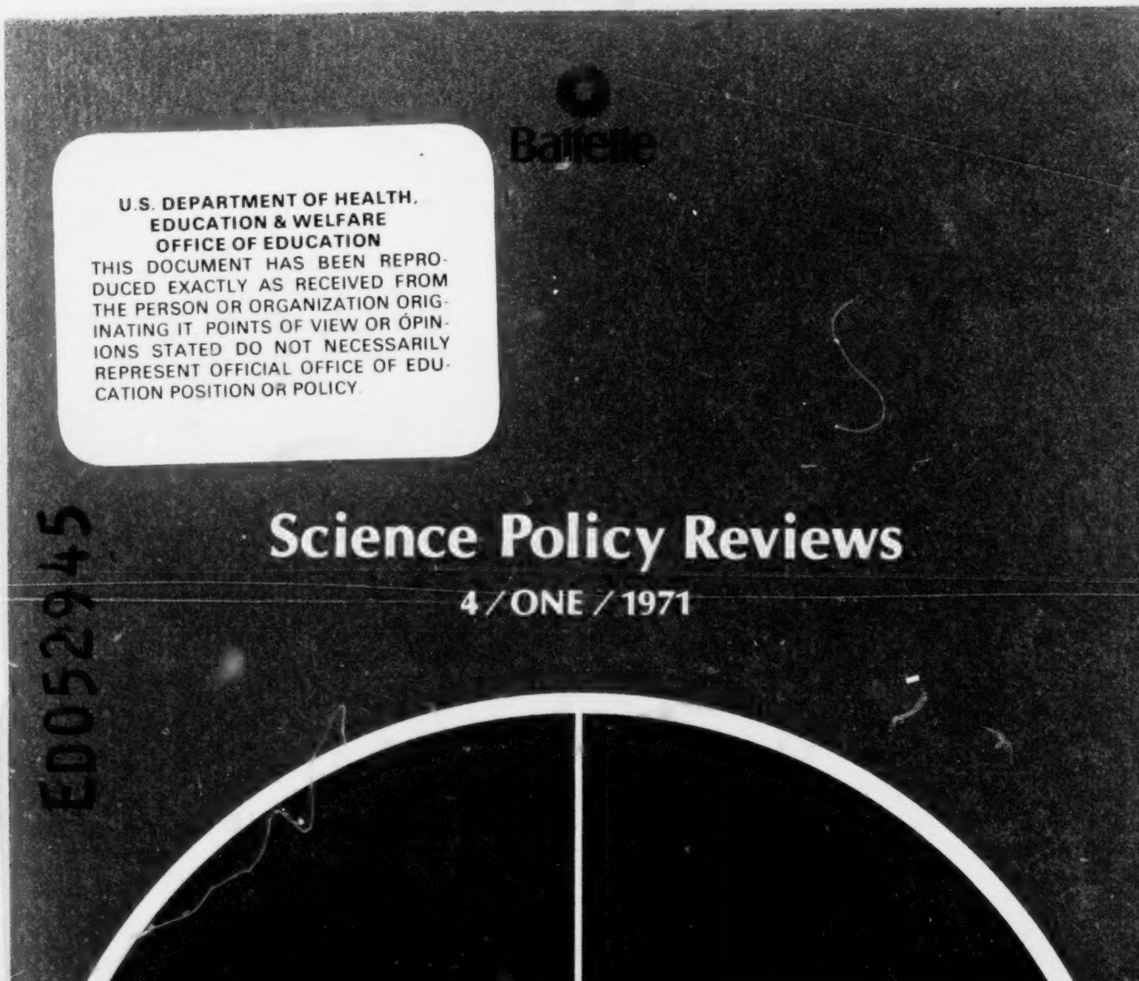
Science Policy Reviews

4 / ONE / 1971



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Science Policy Reviews

Volume 4 · Number 1 · 1971

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Science Policy Reviews is a quarterly controlled circulation publication of Battelle Memorial Institute. The contribution of information to the Reviews as well as suggestions and comments on its content and coverage are welcomed. Please address all correspondence to The Managing Editor, Science Policy Reviews, Battelle, 505 King Avenue, Columbus, Ohio, 43201. *© 1971 by Battelle Memorial Institute.*

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About This Issue

I'd be less than honest if I attempted to disguise or hide my enthusiasm for this first issue of the Reviews. All of you have known for some months, of course, that we were going to change our name and modify our content. You probably also guessed that these changes might result in a "new look" for our publication. And Volume 4 really is new – cover to cover. I hope that you will let us know your reactions to our new appearance and our revised approach to covering our subject – science policy.

Not surprisingly, you should know that we have some rather spirited exchanges between readers and the author. All such exchanges are most helpful.

Predictably, it has proven difficult for us to maintain an inventory of all back issues. Our most frequent -- and regrettable – response to many requests is that we are unable to supply complete sets of back issues, and even our partial stocks are dwindling rapidly. The librarian and archivist will be pleased to learn – and I hope occasionally individuals will be helped – that we have completed arrangements for making available microfiche of all previous volumes and future issues. These arrangements have been made with Columbus Microfilm Inc., 3178 Cleveland Avenue, Columbus, Ohio 43224. Inquiries regarding the microfiche of the Bulletin (past) and the Reviews (future) should be directed to Mr. T. W. McCaw at the above-noted address. / CRT

Science Policy in Action: The Supersonic Transport

by Marjory A. Grieser

While the supersonic transport limped along on interim funding during the closing weeks of the 91st Congress, the Senate debated endlessly over the ultimate fate of the costly high-flying transport. Both sides reiterated their arguments at length, each side more or less supported by various authorities. The arguments turned broadly on several major points: financial and funding aspects, economic factors, and environmental issues. The pros and cons most frequently occurring are listed below, not necessarily in order of importance. A quick scan of these lists will give the reader an idea of the complexities of the problem now facing the Senate.

Pro

- The SST will improve the U.S. balance of trade.
- The U.S. must meet the European competition to preserve its aeronautical supremacy and prestige.
- The precedent of support for the SST has been established in two previous and the present administrations.
- There is no firm evidence that the SST will result in environmental degradation.
- Sonic boom and airport noise will not present insoluble problems.
- High development costs will be regained in income from the sale of SST's.
- Development of prototype hardware is prerequisite to the research and assessment of the SST's environmental impact.
- A large increase in employment will result from continued funding and will relieve current unemployment problems. More jobs will open up in the future when the SST goes into commercial production.
- The development investment to date warrants continued investment; furthermore, contract penalties and closing costs might exceed an additional $200 million.
- The Federal Government should undertake the responsibility of developing large projects such as the SST, since industry cannot afford to.

Con

- The U.S. balance of trade will not be improved or favored by development of the SST.
- The airlines do not want the SST yet, and in fact are having enough financial trouble without the added expense of a supersonic, or the projected hypersonic, transport.
- The SST will not significantly affect employment except in a restricted sector of industry; furthermore, more jobs will be available if funding is shifted to areas of more immediate concern, such as welfare, environmental research, etc.
- The SST is not a good business risk; if it were, industry would have undertaken its development with its own money.
- Funding the SST means that money urgently needed in other, more important programs will be spent instead on an uncertain technology.
- Environmental hazards of the SST may be great, and there is no available assessment of the overall relationship of the SST to world climate.
- The present inadequate state of environmental research needed to assess the impact of the SST should be remedied before prototype production. If the research is not undertaken until after prototype production, established funding precedent may push the SST into commercial production even if research may eventually prove conclusively that it presents serious hazards.
- Sonic boom and noise problems, as well as ground overpressure problems, have not been thoroughly investigated, and no corrective technology has as yet been favorably demonstrated.
- The SST may call for new airport systems. Present airports cannot always be expanded because of their locations in already crowded metropolitan areas. New land supplies are dwindling, and in any case, the costs of these airport systems represent an additional drain on the taxpayer.
- SST's would consume more fossil fuels than our disappearing reserves can supply.
- Development of the SST results in subsidizing the few who can afford such costly transportation at the expense of the general public: in fact, the number of people who would use the SST is so small that subsidizing its development with public funds is not justified.
- Foreign competition and U.S. prestige are not adequate motives for development.
- A serious reordering of national priorities needs to be undertaken to determine the importance of the SST relative to other matters.

Underlying Issues

As one reads the volumes of testimony in the *Congressional*

*Record** and news articles about the debate, several important factors become apparent. Most significant is the fact that "the Nation has no formalized science policy to guide it", as pointed out[1] by the former Chairman of the Subcommittee on Science, Research, and Development, Emilio Q. Daddario. Corollary to the lack of a formalized science policy is the apparent uncertainty about an understood order of national goals and priorities. Also, there is considerable disagreement among scientific authorities about environmental side effects of the SST, and among economists about national and international economic effects of the SST. And there are strong overtones of politics interacting with the scientific and economic aspects of the debate.

National Science Policy and National Goals and Priorities

The Report of the House Subcommittee on Science, Research, and Development notes[1] "that the Congress had never made a sustained inquiry into the question of a national science policy per se – although it has many times considered isolated facets of science policy, usually in connection with some specifically defined problem, program, or mission". The Senate filibuster clearly illustrates the difficulties being faced in their attempt to deal with a problem that involves questions of public welfare, possible environmental damage, technology assessment and control, and economics, *without some formal science policy* that can be used as a frame of reference. The Subcommittee Report further states that "a national science policy can be promulgated only by the Federal Government in collaboration, of course, with other government and nongovernment communities engaged in scientific activity. But no other entity, public or private, has the purview, scope, or authority to undertake the task." The Report also defines a second condition: "Any national science policy cannot be considered separate and apart from national policy itself. That is to say, science policy must be part of and blend readily with the overall goals, objectives, and priorities which are established by the American public through its duly constituted governmental process. Each policy is dependent on the other."

The decision on the fate of the SST is bound to have a significant effect on the direction of U.S. science policy and technology control in the future, especially in the extent to which the decision bears on a reordering, explicit or implicit, of national goals and priorities. For example, a strong indicator of priorities can be seen in the analysis of Federal budget allocations; that is, the budget allocations reflect, in dollars, the measure of concern with any given problem and thus imply some ordering of concern or priority.

The other side of the coin is the degree to which budget allocations are determiners, rather than reflections, of priorities. This idea of an allocation as a determiner of priority illustrates the role of precedent in the formulation of goals and priorities, since it is observable that once a project has been given a place in the budget, it has a sort of priority. Once the project has overcome the hurdle of initial funding, it gains stature and accumulates further funding the longer it remains in the budget allocations.

**Congressional Record* issues covering the period November 25, 1970, to February 10, 1971.

Current awareness of social and environmental problems is penetrating to the legislative function, and priorities appear to be undergoing definite, if as yet not fully determined, shifts. These newer concerns are beginning to establish their own budget precedents. However, the priority of the SST was established in 1963 by President Kennedy at a time when unhindered technological progress was seen as providing only benefits, and the program was undertaken against a backdrop of national soul searching and reaction to threatened Soviet technological superiority.

The question here is how much weight does or should precedent alone carry in the formation of national goals and priorities, and thus in national science policy? The SST decision, regardless of which way it goes, may reflect the extent to which precedent does affect national policy, and that decision itself will then become another precedent that will affect future decisions on similar problems. Even no decision could set a precedent of "policy by default", that is, a policy of allowing technological developments to "happen" as opposed to a policy of technology development that proceeded according to some preconceived overall plan.

Another important aspect of the impending decision is that it will probably indicate also the extent to which other factors will influence public policy – such factors, for example, as scientific research, economics, national and international politics, and human welfare. The degree to which these considerations actually do enter into the processes of planning and control, and the weight they are given, is not yet clear.

Daniel Moynihan points out[2] that "given the interconnections of things, it follows that there is no significant aspect of national life about which there is not likely to be a rather significant national policy. It may be a *hidden* policy. No one may know about it; no one may have intended it. But it is a policy withal". That significant shifts in policy are occurring is also noted in the article, and these shifts are described as a "movement away from program-oriented government toward policy orientedness [which] is at once a manifest, almost visible, phenomenon, and yet is largely unofficial, even informal. It may be likened to a change in sensibility in cultural matters. A time comes when persons see things differently from the past, and, accordingly, act differently".

The goals aspect of the issue seems to be the crux of the Senate conflict. The SST advocates are concerned that the idea of technology control may really mean technology repression. There is the feeling that if the SST is held up or defeated altogether, important technological spinoff will be lost. There is also the fear that defeat of the SST means that the United States will be committed thereby to a policy of suppressing technology development, while the rest of the world catches up to and surpasses the United States. The opponents of the SST, however, see the issue in terms of the possibility of irreversible environmental damage, and they question the value of spinoff in view of the price that may have to be paid in terms of human welfare. Again, there is the fear of committing the U.S. to a policy, but in this case, the fear is of a policy that puts technology development ahead of human development and welfare.

The demands reflected in the *Congressional Record* range from complete stoppage of work on the SST technology to virtually unhindered development of the SST. In between these two extremes there are varying levels of development, under some as yet undefined control. Resolution of differences about goals and priorities will undoubtedly involve some difficult tradeoffs between the two extremes: that is, control to prevent environmental disaster and support to ensure steady technological progress. This middle ground, where the answer may probably be found, has not yet been thoroughly explored. Nevertheless, the Senate debate indicates that the area is beginning to be explored. It is possible that in exploring the middle ground, points of agreement may be found, and these points of agreement could serve as a starting point for constructive dialogue on solution of the problem. A hasty cure could turn out to be more damaging than the disease, and for this reason it is possible that to make too quick a decision on a signal issue such as the SST is not wise. Moynihan points out the dangers: "The perils of choosing national goals on the basis of inadequate or misinterpreted information are surely matched by the dangers that arise when progress toward national goals that have already been chosen is assessed on a similarly inadequate basis. The difficulty with national goals is that they too quickly become standards by which to judge not the future but the present. . . . The setting of future goals, no matter how distant, drains legitimacy from the present conditions."

Disagreement Among Authorities

The biggest charge levelled against the SST has been that of environmental damage. The best that can be said is that the authorities disagree. No attempt will be made here to summarize the arguments, much less to evaluate them. Once the charge of environmental damage was introduced into the testimony, the arguments that erupted on both sides of the question contained a curious blend of science, politics, and economics. Scientific research and authorities were quoted by both sides. Letters from scientists, as well as from economists, and articles from newspapers and periodicals were cited and read into the *Congressional Record*. One thing was abundantly clear: all authorities, presumably having access to the same information, disagreed on any or all points of the environmental-hazards issue. The same is true when economists are consulted on such issues as the effect of SST on the present and future balance of trade, employment problems, and financial returns on the investment.

Scientists argued the issue at the American Geophysical Union in San Francisco. "Evidence" on either side appeared to be mostly speculative, and Rand Corporation's Dr. Stanley Greenfield conceded[3] that "some of the needed information on environmental effects can be obtained by modeling, . . . but ultimately, the actual emissions, reaction rates, etc., must be known". The study by MIT, known as SCEP (for the Study of Critical Environmental Problems), was presented as evidence that the prototype development posed no threat to the environment. Sen. Henry Jackson quoted[4] a supporting statement by Dr. Will Kellogg, chairman of the study, favoring a "vigorous environmental research program in parallel with prototype SST construction" and further noted that Presidential science adviser Edward David "submitted the names of 34 distinguished American scientists who oppose the denying of further funds for experimental work on the SST."

Another sample of the conflict of scientific opinion was read into the *Congressional Record*[5] by Sen. William Proxmire in discussing the problem of pollutants and noise. The editorial[6] quoted by Proxmire took James Harford, executive secretary of the American Institute of Aeronautics and Astronautics, to task for some "breathtaking assertions": "Mr. Harford asserts that the SST will cause only 2.5 pounds of 'overpressure.' But the Federal Government tactfully stopped sonic boom tests over Oklahoma City because overpressure of only 1.3 to 1.7 pounds provoked such painful noise levels. It is perfectly true that the SST will climb faster than existing jumbo jets, but the harsh fact remains that while climbing from zero to 1,500 feet, the SST will make ear-shattering noise louder than anything today's jets produce. No solution is in sight."

It is understandable, in view of the relative newness of the academic fields of environmental and ecological studies, that such extremes of opinion exist among authorities. The lack of agreement, as well as the incompleteness of our understanding of environment and ecology, underlines the necessity of research. Again, the Subcommittee report[1] summarized the matter succinctly: "when . . . we are called upon to handle hard, specific questions – our answer more often than not is 'I don't know.' It makes little difference whether we are dealing with pollution, transportation, unemployment, crime, education, health care or international trade, all too often we do not have sufficient accurate information on which to base rational decisions for the years ahead. We have a plethora of questions but a dearth of answers. Answers come with knowledge. Knowledge comes with research. Research means scientific investigation . . . physical and social. Solutions require the appropriate application of research results".

Administration Pressure?

Daniel Moynihan had another observation with regard to guidelines: "It is not for any one person or administration to assert what those guidelines ought to be, but there is likely to be a fair consensus that high on any such list would be the principles of participation and of accountability."

Early in the Senate debate, the President had formed an ad hoc committee to study the SST program. Last December 3rd, Senator Muskie took the floor of the Senate[7] and charged the administration with suppressing the report of its own committee because the report stated that " 'there is substantial reason for *delay* in proceeding to the next stage of the SST project – prototype production.' " The Senator went on to say that "the committee emphasized that 'there is an urgent need to carefully evaluate the inherent operational and environmental hazards that will be encountered while accelerating from zero to Mach 3 and cruising at supersonic speeds in a hostile environment.' Has that evaluation been made since the committee met? It has not."

In testimony presented the day before,[5] an article read into the Record noted that the U.S. Treasury, the Department of Labor, and the Council on Environmental Quality originally came out against the SST, and all later reversed their positions. The Treasury Department earlier said that the SST would hurt the U.S. balance of payments because people would travel more and spend U.S. money overseas. The Department of Labor originally felt that "the SST offered little hope of important job benefits".[8] The Council on Environmental Quality, earlier full of warnings about SST dangers, now emphasizes that the two prototypes will not be harmful. "A high Cabinet official suggests, however, that the real reason for the dramatic turnarounds in agency opinion [is] intra-Administration pressure. 'The Administration favors the SST,' he says, 'therefore, all parts of the Administration favor the SST'."

What's Going on Now?

Despite the controversy, the SST "hardware and tooling are taking shape"[9], and according to H. W. Withington, general manager of the Supersonic Transport Division of the Boeing Co., " 'We have not missed a schedule since the Senate vote. The subcontractors are charging ahead, on schedule and budget.' " Administration officials hint that the President will shortly "make a firm stand for the program".[10] Program work pace at Boeing and General Electric has been slowing down, reflecting the curtailment of funds, but it is expected that "word from the White House will trigger major public relations and lobbying efforts by Boeing and GE to swing votes around to favor the program".[10]

The Department of Transportation is planning mathematical-model studies to calculate "the effects of such aircraft on the atmosphere, climate and weather. The models will be verified by a measurements program before they are used for prediction."[11] Dr. Robert Cannon, assistant secretary of the Department of Transportation announced the study, which will be directed by his office. The study is expected to take about 2-1/2 years, and Dr. Cannon observed that "I believe that, in the context of weather and climate effects, evidence required to make production decisions can be obtained to a large extent before flying a prototype of the American SST."[11]

What About the Competition?

The British-French contribution to the supersonic-transport technology, now in prototype test stage, has opened the door to further speculation and disagreement. A special report on the Concorde[12] discussed early results of flight tests, and included an article on British efforts to gather detailed data on environmental effects. The flight-test corridor through Scotland, England, and Wales has been instrumented by the Royal Aircraft Establishment to make detailed studies of effects along the flight path. Also of interest is the fact that the British government has "funded studies by scientific teams from 11 British universities, all of which are operating independently from the official ministry groups".[12] While the overall report is generally favorable to the Concorde, other reports are not so optimistic. Higher-than-expected fuel consumptions have been reported, and one article reproduced in the *Congressional Record*[5] observed that "the cost to the British taxpayer is now running at $158 million a year. By a nice irony, that happens to be the exact amount that the new Conservative Government says it will save by the much advertised cuts and charges it has just decided to impose on health and welfare services." The article also notes that "promoters say it [Concorde] must be built to show that Europeans can for once beat American technology. At the same time, the industrial and political backers of an American supersonic transport say their SST must be built to compete with Concorde."[13] Another article[14] calls attention to the rising-costs problems faced by both governments, as well as the similarities in arguments used on both sides of the Atlantic. It mentions that "a rising tide of trouble has threatened to engulf the Concorde, two prototype models of which are already flying in Britain and France... Rising costs are forcing the two governments backing the airplane to take another look at the desirability of going ahead with what at best may be only a marginally justified venture. This is the chronic problem, which several years ago was so serious that the British tried without success to drop out of the joint venture with Gen. Charles de Gaulle's France."

No orders have yet been placed for the Russian SST, the Tu-144. It is estimated that the Tu-144 may enter service in 1972, and that Aeroflat and Russian Satellites may use 20 such planes.*

Where Do We Go From Here?

At the time of this writing (early March), the 92nd Congress has been conspicuously silent on the SST issue. There can be no doubt that Congress is gathering its forces for another attack on the problem, this time perhaps to reach an agreement of sorts by March 31, when the

*"The USA/SST and the Competition", The Boeing Company Commercial Airplane Group, Supersonic Transport Division, February 1971.

interim funding expires. So many questions have been raised, but, sadly, none have been resolved, mostly because the issue is a complex blend of science, technology, economics, and politics. A starting point might be the formulation of a set of relevant national goals, and an ordering of these goals into their relative positions of priority. Without some agreement on the ordering of priorities, as well as a definition of goals, it is difficult to approach the formidable task of setting up a formalized science policy. In practice, all the issues involved – goals, national policy, economics, technology control, and welfare – will probably have to be assaulted simultaneously. Though the National Goals Research Staff was being dispersed in August 1970, "the need for long-range analysis and planning has not been met, nor will it disappear. The President has a responsibility in the matter which, if unfulfilled, is likely to become the province of Congress."[15] The problem of ordering priorities does remain with us, and until some progress is made, it is likely that a clearly defined science policy will go begging.

Parallel problems of the SST and the Concorde in virtually all areas – economics, environment, fear of competition – indicate that the problem could bear much more scrutiny from the international or global point of view, rather than from the national view alone. SST's will not be limited to flights over the countries producing them. Studies of the effects of SST's on global climate and environment would be facilitated by international research efforts. The need for organized research, basic and goal-oriented, national and international, seems imperative, in view of the fundamental disagreements among scientists and technologists over existing data. National research programs are barely under way, and most seem to be in the preliminary stages. Even so, it is not too early to think about global cooperation; in fact, without global cooperation, significant data might be lacking to any or all of the nations involved in studying the problem.

Finally, open documentation of studies and research is important. Today, public opinion plays a large role in determining national policy, and interacts in the interconnected social system along with scientific, economic, and political pressures. This point is emphasized by Daniel Moynihan[2]: "Documents . . . can become one of the essential channels by which the options before the Nation are presented in specific and comprehensible terms so that it becomes possible for a body of public opinion to form in advance of the time when government does or does not make decisions about which directions to move. (Note particularly that a decision to do nothing is very much a decision.) In the past, having had so little understanding of what our options might be, most decisions have gone by default in this negative fashion. The great power of social data is to inform us as to what possibilities may exist."

Perhaps, in the near future, we shall know what possibilities exist with the SST.

Note: Since this article was written, the SST received its final defeat in the Senate with a vote of 51 to 46 against continuation. With tongue decidedly in cheek, it is suggested that U.S. purchase one or two

Tu-144's – or Concordes – as a cheap and practical means of obtaining an SST for environmental and other studies. The Boeing article, footnoted earlier, asserts that the price of the Russian plane may be legislated to make it competitive. Such a purchase would be vastly less costly to American taxpayers than development of their own prototypes!

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"The nation has no formalized science policy to guide it." *These words were written last October by the Hon. E. Q. Daddario, then chairman of the House Subcommittee on Science, Research, and Development, in his letter of transmittal of a report entitled Toward a National Science Policy for the U.S. (see Science Policy Bulletin, v. 3, no. 6, December 1970, Abstract 1059).*

Richard D. Lyons, a staff writer for the New York Times, sifted through the report's 18 pointed recommendations, testimony by more than 60 witnesses at science policy hearings held by the Subcommittee over a 3-month period last summer, and policy statements by a number of high-ranking Federal science officials, and came up with the following penetrating article on where the Administration is heading with respect to science policy.

Nixon Reorganizing Vast Federal Science Complex*

by Richard D. Lyons

The Nixon Administration is moving to make the hydraheaded Federal science and technology apparatus more responsive to the nation's needs, a feat that has eluded the most herculean efforts of policy planners since the research and development boom began a generation ago.

Central to the new effort, which will be given its first test next year, is the identification of priorities in areas of science and technology and the weighing of the priorities against one another to determine where they will rank in the struggle for Federal dollars.

Senior Federal officials have said that assessments will be made of relative rank and that the trading off of priorities will eventually result in difficult and perhaps controversial decisions as some areas of development win out over others.

Some experts here are doubtful that rational decision-making and management practices can ever succeed in imposing order on the complexities of science policy. But interest in making the effort has developed in Congress as well as in the Executive.

Just today a House subcommittee made public a report urging a revamped Federal organization for the planning and management of scientific research and development and the creation of a special committee to draft a master plan for science policy.

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Officials in the White House Office of Science and Technology and the National Science Foundation said in interviews that they were determined to bring a better sense of order to a system that spends $16-billion a year in Federal funds and has, as one example, several dozen agencies conducting oceanographic research.

In the last year of Federal belt-tightening, science has repeatedly been portrayed as a rudderless ship, lacking in direction, purpose and, more important, Presidential concern. According to Dr. Edward E. David Jr., the new Science Adviser to the President, "Things are going to change."

The reorganization efforts will focus on the $14-billion a year worth of applied research and development programs that seek to take the knowledge of science and translate it into better housing, mass transportation, cleaner air and healthier people.

Dr. David emphasized that pure and basic research, fields that seek answers to such esoteric questions as how the moth mates, would be specifically exempted. About $2-billion a year of Federal funds is now allotted to those areas.

Dr. David said he was seeking to bring about "something between a scientific high command and the present system, something that will come up with priorities of programs rather than wish lists." A strict scientific system in itself is impossible, he said, because science is a tool, not a system.

The tightened system is a product of conversations between Dr. David, Dr. William A. McElroy, the director of the National Science Foundation, and lesser science advisers in the Administration in the 10 weeks [now close to 7 months] since President Nixon chose Dr. David as his chief science aide.

More for the Money

Getting more results from the shrinking research and development dollar seems to be the intent of the priority assessment program, which contains a major variation on an old theme.

As in previous years, it involves obtaining the advice of specialists at the National Science Foundation, the National Academy of Sciences, the National Academy of Engineering, Federal agencies such as the Department of Agriculture and the Atomic Energy Commission, the Federal Council on Science and Technology, and the White House Office of Science and Technology.

As outlined by Dr. David and Dr. McElroy, the National Science Foundation would furnish a wide range of research and development ideas to the National Academy of Sciences for analysis. Committees of the 800-member academy, working under contract, would assess the value of particular ideas.

The National Science Foundation would then take the judgments to the so-called mission agencies, such as the National Aeronautics and Space Administration, and compare them with the current and proposed level of support being conducted or underwritten by governmental departments and agencies.

The foundation would then, as Dr. McElroy put it, "see to it that nothing fell between the slats" and present a package of priorities to the Office of Science and Technology.

Would Rank the Priorities

Experts there and members of the Federal Council of Science and Technology would rank the priorities in order of importance and Dr. David would present the list to the President.

"The new aspect," Dr. David explained, "will be to make choices between fields, judge their relative importance and relate them to national goals. In addition, we will be seeking major inputs from industry and the general public."

The innovations will seek to correct deficiencies that have long been recognized by experts in science policy. The lack of greater participation in the forming of science policy and the failure to set priorities were major recommendations of the President's Task Force on Science Policy.

Dr. McElroy ticked off these specific examples of the several dozen ideas that are under consideration:

- Biological control of insects that might, perhaps within five years, make chemical insecticides such as DDT obsolete.
- Increased study with radio astronomy of the mysterious pulsars and quasars in the nether regions of the universe to unravel their as yet unexplained sources of intense energy. Comprehension might, perhaps in a generation, lead to new energy sources for a world that is depleting its fuel supply.
- Increased research into the basic mechanisms of drug addiction in an attempt to suggest more practical solutions to breaking the chain of biochemical events that leads from abuse to addiction.
- Furthering research into human cellular development that could be aimed at correcting through genetic and enzymatic engineering some of the 1,000 or more diseases that man may be heir to, such as diabetes.
- Increased support for oceanography that could lead to a larger food supply and better control of our polluted river estuaries.

But what ideas would have to be set aside? This, Dr. McElroy acknowledged, would be the most difficult problem.

'The Toughest Question'

"It will hurt when David has to make the hard decision of what not to concentrate on," he said. "What will be at the bottom of the totem pole is the toughest question to both ask and answer."

"The thing that is evolving is a response in a budgetary way to the formation of science policy," he said. "Our own thinking is that we weren't doing the job that we should have been doing all along."

As an example, he blamed the top echelons of the "scientific power structure" for their delays in heeding public demands for a better environment.

Scientists are deeply distrustful of attempts to tell them how to conduct their research and what to investigate. Recognizing this, Dr. David insisted that he was seeking neither to set the direction of basic research nor to set himself up as a "science czar," a specter scientists repeatedly refer to when the question of focusing their efforts more sharply arises.

"The public wants science and technology to serve its needs," he said. "Our job is matching them, as well as exerting leadership in science."

That is exactly the point of today's report by the Subcommittee on Science, Research and Development of the House Committee on Science and Astronautics. The report, entitled "Toward a Science Policy for the United States," digests several months of hearings last summer during which dozens of witnesses criticized current science policy.

Policy Panel Urged

The subcommittee chairman, Representative Emilio Q. Daddario, Democrat of Connecticut and a candidate [unsuccessful] for Governor of that state, said pointedly that "the nation has no formalized science policy to guide it." [The new chairman is Representative John W. Davis, Democrat of Georgia.]

The subcommittee's main recommendation is that the Administration immediately form a special committee to draft a basic national science policy by the end of next year. It urged that both the legislative and executive branches of the Government join in the study.

It also called for the strengthening of the Office of Science and Technology. The President's science adviser now sits beneath the salt in the White House table of organization and efficiency, ranking twelfth among executive assistants between Charles B. (Bud) Wilkinson, former football coach and special consultant for voluntary action, and Ronald L. Ziegler, the Presidential press secretary.

The Office of Science and Technology, the nation's most powerful research and development planning body, only has 22 professional staff members. The House subcommittee urged additional staffing and legislative backing.

Simplification and centralization of jurisdiction over science and technology in the Senate was also recommended. Scientific and technical affairs are dispersed through dozens of Senate committees and subcommittees.

The report also urged that national science policy be enacted in statutory form, that a National Institute of Research and Advanced Studies be created, that a new Office of Technology Assessment be set up in the legislative branch, and that the Bureau of Management and Budget plan in advance to prevent "boom-and-bust" cycles of science funding.

"It is my conviction that unless such a combined legislative-executive effort is made and a feasible science policy worked out that the nation will continue to flounder in its efforts to solve many of the issues confronting it," Mr. Daddario said.

Scientists themselves have repeatedly complained in the last year that something was wrong with the system, although to the minds of most of them it was a lack of money rather than organization. During the yearly assemblage of the National Academy of Sciences last spring, members time and again warned that the United States was losing its pre-eminence in many areas of science and technology such as physical chemistry, radio astronomy and solid state physics.

Dr. Philip Abelson of the Carnegie Institution, a speaker at an academy symposium on "the crisis in the Federal funding of science," said American scientific research efforts had dropped 30 per cent in the last three years because of attrition in Federal support.

Lack of Direction Seen

"If we continue to cut down at 10 per cent a year the United States is going to be a second-class nation in scientific enterprise," he said.

It was not only a lack of money but also a lack of direction that concerned Patrick E. Haggerty, board chairman of Texas Instruments, Inc., and a member of the President's Science Advisory Committee. He said that the nation, led by the White House and Congress, needed to define scientific priorities and adapt spending to them.

The National science Board, whose members are appointed by Mr. Nixon, warned him earlier this year that trimming the Federal investment in research and development would lead to "a day of reckoning for United States science and for the national well-being."

"That day may be very near," the board said in a report that was released by the White House without comment.

The President's Task Force on Science Policy reported in May after a six-month study that the national science effort needed better planning and direction, as well as money. More money, however, is not considered a short-term possibility. The current research and development budget is the lowest in five fiscal years; in terms of constant dollars it is the smallest in a decade.

There have been indications all year that a harder position will be taken on future science budgets. For example, Murray L. Weidenbaum, the Assistant Treasury Secretary for Economic Policy, who is regarded in the Government as a herald of significant policy changes, warned last week that the Administration intended to take a sterner look at its annual investment in research and development.

Mr. Weidenbaum said that when he had looked at "the actual justifications for undertaking many new major scientific projects, I was often struck by the absence of that objectivity and hard, factual, quantitative analysis that I associated with the core of the scientific method."

Research 'on Faith'

"I am amazed," he told an aerospace meeting in Houston, "when scientists say that we must embark upon a major technological project on faith — faith that through serendipity . . . it will turn out to be worthwhile after all."

Mr. Weidenbaum said that it was the Administration's intent to have, in requesting Federal aid for a project, scientists and engineers ask:

- Are the expected benefits worth the cost?
- Have important elements of cost to society, such as polluting the environment, been omitted?
- Are the returns likely to be greater than those from alternatives?

The idea of getting the Federal Government more for its money has also been brought up by Elliot L. Richardson, Secretary of Health, Education and Welfare, whose department oversees $1.2-billion worth of basic and applied research at the National Institutes for Health.

"We see the need for more clearly defining what we know and how to change existing projects," he said. "It is more acutely important now than ever to sharpen tools and invent or adopt the devices to get to the national interest."

If the Nixon science managers can get a firmer grip on the system, they will have done something that has defied the attempts of many others. Ever since Albert Einstein sent his famous letter to President Roosevelt urging support of atomic research, through private rather than public funds incidentally, there has been a proliferation of Federal research and development agencies, some of which were originally conceived to supervise the system.

'Never Had the Clout'

The National Science Foundation, the Office of Science and Technology, and the Federal Council on Science and Technology were all supposed to sort out, identify and set priorities.

"They never had the clout," said a Congressional expert on science policy. His view of the efforts of Dr. David and Dr. McElroy is that their concept is sound, but does Mr. Nixon really mean to give the Presidential science adviser the power he seeks?

"The Office of Science and Technology has been out of the budget process, and George Schultz (head of the White House Office of Management and Budget) had made the real decisions about science," he said.

For example, when the science budget for the current fiscal year was announced in February it was apparent that Dr. Lee DuBridge, Dr. David's predecessor, had not been told what it was.

Dr. David insists that things are different now. As an instance, he cited the fact that his office now has observers in the Bureau of Management and Budget. He acknowledged that Congress could be another problem, but he said that it would be consulted in national science priorities before major decisions were to be made.

According to one Congressional specialist, Congress might be receptive to tightening the reins on the "R&D" budget. "That's what we've been calling for," he said. "Somewhere in Government it has to come to intercomparison – you have to balance the moon with the environment."

But Congress will remain a big question mark in attempts to change science policy. As Dr. DuBridge said earlier this year:

"Even if one had a very well-considered, rounded, balanced program for our national science effort which was presented by the President in his budget, it is not at all sure that it would come out of Congress still adequate or well-rounded or adequately balanced."

SEABORG'S SILENCED SPEECH

Last December 30, Dr. Glenn T. Seaborg, chairman of the U.S. Atomic Energy Commission and newly elected president of the American Association for the Advancement of Science, stepped into a jammed conference room at the AAAS meeting in Chicago, manuscript in hand, all set to deliver an address. The Symposium topic was "Science and the Federal Government – 1970".

Dr. Seaborg had been forewarned that vocal activists were planning to prevent him from speaking and to indict him publicly for "crimes of science against humanity". Noting the rude treatment accorded the speakers ahead of him, he acceded to entreaties by other AAAS officials and ducked out by a side door, carrying with him his unread manuscript.

As if prophesying and trying to avert such events, Dr. Seaborg, in a guest editorial two months earlier in Astronautics and Aeronautics, wrote, "The most important step we face now is to foster more dialogue and less confrontation over our differences to the solutions [to the basic problems of society]. For this we must have – all essential – time, patience, new knowledge, and a new spirit of good will."

Ironically, the unwillingness of the dissidents to abide by these precepts kept them and others from hearing an address that contains much that should appeal to persons genuinely concerned with contemporary problems and the role of science in solving them. To give the readers of Science Policy Reviews the opportunity that was denied the AAAS conferees in Chicago, we reproduce the complete text of Dr. Seaborg's silenced speech here.

New Frontiers of the Mind

by Dr. Glenn T. Seaborg

This symposium, with its retrospective and prospective view of American science, spans the last half of the twentieth century. We stand today virtually at the halfway mark between Vannevar Bush's classic report and the year 2000. From this vantage point the horizon is about the same distance whether we look forward or backward, and it seems wise to do a little of both. Those who planned this symposium were correct, I think, in beginning with the Bush report and those exciting days in which it was written. By going back to 1945 we can see how far we have come. But even more important, we can see how the spirit and foresight of those days helped to mold that future which is now our recent past.

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Origins of Government-Science Partnership

The spirit of those days, which a rereading of the Bush report brings back so forcefully, was one of confidence and optimism. In the wake of one of the most destructive and terrible wars in human history, we might not have expected the kind of positive and hopeful attitude which seems to have been common among American scientists in 1945. And when we stop to think about it, it is even more surprising that this confident expectation of the future was prominent among those of us who had worked to give birth to the nuclear age as it was introduced to the world.

Looking back on those days from the vantage point of the 1970s, I would conclude that the very success of our efforts, although we had produced the most awesome weapon of all times, was the source of this surprising self-confidence. We had demonstrated (and most of us in those days were very young and inexperienced in the world outside the laboratory) that the scientific method could be applied to the solution of the most difficult sorts of problems. In a rather broad sense, the young men who had built the atomic bomb had not only solved some exceedingly complex technical problems, but they had devised something that had ended in a most dramatic fashion the greatest war in human history.

Confident expectation, however, was something that existed far beyond the Manhattan District laboratories. It appeared in a most striking form in President Roosevelt's letter to Dr. Bush asking him to prepare his report on American science. In that letter the President said:

> "New frontiers of the mind are before us, and if they are pioneered with the same vision, boldness, and drive with which we have waged this war we can create a fuller and more fruitful employment and a fuller and more fruitful life."

Vannevar Bush took these words seriously. He declared in the first paragraph of his report that science could be effective in solving the problems of the modern world. From that important premise he went on to describe what science could do and how it might be organized to accomplish the task. His main point was the one which provided the theme for this symposium – that the future required a new and much stronger partnership between science and government. Scientists could no longer pursue their research without government support, and the government could not hope to resolve the political, economic, and social problems it faced without the scientists.

As the structure for this new partnership, Bush suggested not only a National Research Foundation, but a variety of relationships which have tied inextricably together two of the most powerful forces in our society. Not only the National Science Foundation, but the Atomic Energy Commission, the various research organizations of the Department of Defense, the National Institutes of Health, national laboratories to serve as regional centers of research, and the vast system of support of academic science which we know today – all fall within the horizons Bush envisioned in 1945. That Bush did not accurately foresee every development of the quarter-century after World War II is of little consequence. He did not predict Sputnik, the space race, or the Apollo series. But what is far more significant, he did understand the dynamic potential of American science and its relevance to the problems of modern society. And he presented a practical plan for applying the power which scientific discipline made available.

After listening for three days to the many speakers and panels of specialists who have taken part in this symposium, we cannot help but be impressed with the accomplishments of science in the last twenty-five years and especially with the effectiveness of the government-science partnership. The program for the symposium, which seems to have been based on the outline of the Bush report, includes the major features of that record. I cannot attempt here a summary of what has been said in these sessions, but it is perhaps helpful to note the diversity of the topics covered.

Products of Government-Science Partnership

On Monday afternoon and evening we heard some fascinating discussion of the evolution of science museums and libraries during the last decade. As the volume of scientific literature and artifacts has increased at an exponential rate, new institutions have been established which have effectively broadened the cultural base of science. To mention only two institutions which I often see in the course of my travels about the nation's capital, the National Museum of Science and Technology (part of the Smithsonian) and the National Medical Library at Bethesda illustrate the excellence and variety of these new institutions. The Museum of Science and Technology, which was designed to portray the accomplishments of science to the general public, has been an outstanding success. I understand that it has become one of the most popular tourist attractions in Washington. The National Medical Library, at the other end of the spectrum, is a highly specialized library, at last housed in a suitable modern building and meeting a need foreseen in the Bush report.

Yesterday's sessions concentrated on two of the most effective ways in which government has exercised its partnership with science. One is the direct support of academic science through a system of Federal grants. The other is the provision of great national laboratories such as the National Institutes of Health, the National Bureau of Standards and the regional research centers operated by the Atomic Energy Commission. These national laboratories have done more than make available to the academic scientist the complex research apparatus which university budgets could not afford; they have also set new standards of excellence which the universities have been challenged to adopt. The three roundtable discussions yesterday illustrated in a most dramatic way the extraordinary achievements which the government-science partnership has made possible.

This morning's session on worldwide scientific activities directed our attention to one of the most interesting, and I believe fruitful, products of the partnership. Science, of course, has always been international in its spirit, but in the last two decades we have witnessed the emergence of new forms of international cooperation which have dwarfed those of earlier years. This development seems all the more remarkable to me when we consider the dismal prospects for such a trend in 1945. The wartime alliance of science and government, particularly in such highly secret projects as the development of radar, the proximity fuse, and the atomic bomb, threatened the traditional channels of international cooperation and communication. The severe limitations imposed by the Atomic Energy Act of 1946 were among the most troublesome handicaps we in the nuclear sciences faced in the post-war period.

These limitations, however, proved temporary, and in the 1950s we began to see a new interest in international activities. To a large extent, science produced, rather than merely followed, the international trend. Scientists led the fight for international control of atomic energy. The "spirit of Geneva," which began to thaw out the Cold War in 1955, was in part kindled by President Eisenhower's "Atoms for Peace" plan. From this idea came new forms of international cooperation in developing the peaceful uses of atomic energy and, perhaps even more significant in the long run, the birth of the International Atomic Energy Agency. The many trips I have made abroad, both as a representative of the President and a delegate to the IAEA, illustrate the fact that scientists do have a vital place in interpreting and explaining the policies and interests of the United States to other nations.

Science in a Temporary Doldrum

This brief summary of the retrospective view of American science is not intended to arouse feelings of self-satisfaction about our accomplishments, however justified that attitude may be. I cite these examples rather for the purpose of suggesting that our situation today may not be quite so hopeless as some of us would believe. In many respects the world of 1945 was even more threatening than that of 1970. By looking to the past, we can see that calm assessment of the problems of our day and confident planning for the future are likely to produce better results than a recitation of past failures. Dr. Bush's statement in 1945 to President Truman is just as pertinent today as it was twenty-five years ago:

> "Science offers a largely unexplored hinterland for the pioneer who has the tools for his task. The rewards of such exploration both for the Nation and the individual are great. Scientific progress is one essential key to our security as a nation, to our better health, to more jobs, to a higher standard of living, and to our cultural progress."

Keeping in mind this declaration, what may we expect of science in the last three decades of this century? What should be our orientation in the decades ahead, our outlook and aims, and what might we expect to accomplish?

As I stated at the beginning of my remarks, Vannevar Bush's report of 1945 reflected a spirit of confidence and optimism over the state of science and its potential at that time. Today, though we have witnessed a remarkable success of science in the past 25 years, we are temporarily in a doldrum. I must stress that I believe it is temporary but I think it is important to realize why we are faced with this condition. I speak, of course, not of scientific progress itself but of a combination of other factors – a loss of momentum in the funding of scientific research, a negative reaction to science and technology on the part of a significant segment of the public – distressingly, a large number of students and articulate intellectuals – and the unemployment of many fine members of our profession. While we deplore this state of affairs, it is necessary to recognize why it may have come about so that we can deal realistically with it.

Unification Needed

First, I think we must realize that science is suffering today from a kind of dislocation and disunity brought on by its own success. That is, it has fostered changes in our society faster and with far more impact than our social and political institutions can absorb and manage them. Also, its various disciplines have effected changes at different rates, with differing impact and with insufficient integration to cause problems that have eroded our basis for support and public confidence. Let me expand on these broad statements for just a moment.

The first phenomenon, that of the management of change brought on by science and technology, is a point most widely discussed today and a good many current books, including Victor Ferkiss' "Technological Man," Alvin Toffler's "Future Shock," Charles Reich's "The Greening of America" and Lewis Mumford's "The Myth of Machine," deal seriously and to differing degrees with various aspects of it. They recognize, as I think we all do, that the physical changes brought on by the widespread application of our scientific and technical knowledge has caused serious problems for all the good they have done, and that man's thinking and his institutions must change to resolve these problems. To some extent we have always realized this. Necessity has been not only the mother of invention but also the father of human evolution. We seem always to be learning how to survive. We were first prodded by nature to change in order to meet her challenges and grow. Then our own inventions – tools, weapons, means of transportation and communication – set up conditions that forced us, begrudgingly at times, to alter our ideas and our institutions for handling the problems that our excessive or mismanaged use of these creations engendered. Each and every advance of man – agriculture, medicine, the steam engine, electronic communications, and today nuclear energy and space – has ushered in the need for new thinking and new social instruments, and these have always sorely lagged behind the physical changes effected by those advances. We suffer an even greater lag today because we are feeling the total effect – the symbiotic effect – of having created an entire civilization dependent on science and technology without the extremely well-integrated social instruments and attitudes to manage or plan its future. It is also a civilization built by many sciences and technologies, developed at different times, to different degrees, deficient in interdisciplinary efforts and therefore prone to creating many of the environmental and ecological problems we face today.

But there are now strong indications that we are moving toward a unification and integration of the sciences and technologies that will help to alleviate and solve many of these problems. We are also recognizing the naturally evolving unity of the sciences. For example, as stated in a report on "The Physical Sciences" by the National Science Board*:

> "The natural sciences are approaching a single conception of the organization and structure of matter at varying levels of complexity. The physicist is concerned primarily with atoms and subatomic particles. The chemist deals with atoms as they form millions of different molecules. The biologist in turn deals with tens of millions of species, each one a unique organization of matter."

When stated this way we can realize that all sciences, all disciplines, are in the state of becoming one science and that it is the missing pieces of this huge puzzle of physical reality that we must search out and put into their proper place. (A parallel unification is taking place in technology as the concept of systems engineering is pursued.) But the very recognition of this unity – not just theoretically but in our very real and vital dealings with our ecological existence – is a most important step forward. Now we must make everyone aware, as Oliver Wendell Holmes once said, that "science is the topography of our ignorance" and that it is essential that we advance science if we wish to advance man, if we do not want to stumble blindly ahead into an uncharted future or, just as precariously, hang back because of our uncertainties and apprehensions and retreat further into the turmoil of our times.

For those who are prone to hang back it is easy to lay the blame for this turmoil on science and technology by saying their work has given us a world we never bargained for. But the truth is that it is a world that reflects not merely the deficiencies of misapplications of science and technology but, in effect, mirrors and magnifies all of man. Thus it is a world that forces us to recognize every shortcoming and aberration of human nature as well as its triumphs and great potential. It is also, I feel, a world that will force us to change for the better, to evolve to a higher order of life that will be able to establish a new harmony with its environment as well as a new degree of stability within itself – in other words, live in dignity and at peace.

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*"The Physical Sciences" – Report of the National Science Board submitted to Congress 1970.

What is the role of science in fostering this change? If in the past we have mirrored the shortcomings of man even as we have raised him to new heights, what can we do now to contribute to his survival and happiness rather than to the confusion and crises that seem to abound now?

I cannot but agree with those most perceptive minds of our day who in many, and sometimes painful, ways tell us that we must have a new universal consciousness – a new sensitivity and spirit for evolving mankind – to act as an end to guide the powerful means of science. There is no doubt that science and technology have made the world an "encounter group" and that all of us have been thrown together into a situation where we can survive only by finding in ourselves and each other a deeper meaning for existence. But in learning who we are and trying to assess where we want to go we cannot regard science merely as a means to those ends or disregard it until we agree on those ends. Some would do this. They would set science aside saying we must first find our identity and establish our values, then we can turn back to science to see what it can do for us. But life cannot be dealt with that way. We cannot conveniently compartmentalize means and ends.

Of course it is essential today that we intensify our discussion of goals and values so that we can better assess and direct our scientific and technological efforts. And, as I have stated on many occasions, I believe we are entering a philosophical era in which we are doing this – and this is one reason why we are experiencing a reaction to that support of science which was given carte blanche after the advent of Sputnik. However, it must be realized that the growing knowledge and power of science and technology are constantly altering our goals and values. It is not a question of automatically and mindlessly attempting to do everything these forces make possible, as some insist we have done. It is a matter of setting goals and values in tune with the highest human potential and yet always with the open-ended possibility of further human creative growth, never sure of what possibilities new discoveries in the "topography of our ignorance" will hold.

In other words, even if we should aim for an environmentally "steady state" world, as several claim we should, it should not be one mentally, not an anthill civilization, but rather a world in which there is always the broadest opportunity for individual and social growth.

Both Science and Society in Jeopardy

What can we in the scientific community do to support such thinking and such a thrust into the future? Basically we must announce to the world that the American Association for the Advancement of Science (AAAS) is more than that – that it is an association for the advancement of man. Actually, it has always been that. But this is a message that has become increasingly distorted and almost lost over the past years. Today this fact places both science and society in jeopardy.

We of the AAAS – and all scientists – must counteract the pervasive feelings that the world of science is one apart from the world of man, or that we have reached a science saturation point at which we must set science aside while we tend to "human problems." No thinking could be more dangerous to science or man than that, because every major problem we face today – whether environmental, educational, social or political – has important ramifications that somehow involve scientific and technological judgments or require more and better knowledge that can only be achieved through scientific investigation. Yet the turning away from science by so many – and tragically by so many of our young people – is based on the feelings that it is irrelevant and irreverant in terms of the world we should be building. This is an immense distortion of the truth which all scientists should endeavor to combat.

The time is now – and it is long overdue – for the AAAS, for all its affiliated societies and individual members, to make a concerted effort to bring science and technology a new esteem and a new meaning for all men.

We must demonstrate to all men that the scientific enterprise is a human enterprise dedicated to those high values common to men everywhere.

We must convince the man in the street – and the student in the street – as well as in their homes, factories, schools and offices, that it is through science, and not without it, that the basis for true and lasting world peace is possible.

We must show them that knowledge is not a tool of oppression – of the mind, body or spirit – but rather the key to greater physical and spiritual freedom.

We must help prove to them that the knowledge and power provided by science and technology are the means by which men of good will can release themselves and their fellowman from the ignorance, insecurity and want that perpetuate human conflict and misery.

We must, within our own ranks, strive for a new unity, direction and sense of purpose and convey these to the highest level of national and international leadership.

Public Understanding Essential

I know that I am not alone in these feelings, that they are shared by all of you and have been publicly expressed by many of you. For example, on the issue of science policy I wholeheartedly agree with the beliefs of Bill McElroy (Dr. William D. McElroy, Director of the National Science Foundation) that scientists must be more aggressive in bringing the issues, deliberations and thinking of science to the public. I believe that if we are going to have a rational science policy in this nation it must be based on a broad public understanding of the all-encompassing role of science, not on a series of crisis reactions. If science is looked upon merely as society's "rescue squad," cranked up only to respond to external threats or internal disasters, there are bound to be continued frustrations and failures on the part of both science and society.

As Dr. McElroy recently stated:

> "I don't think the scientific community has ever really worried about science policy. If the money is flowing in to support good scientists and to get good work done, I don't think they care what the policy is . . . . Science policy – if you can call it that – has been a social-political decision. The money going into science, the big money, was a post-Sputnik response – not a scientific decision. This is what a lot of scientists have forgotten. We haven't been doing our homework enough in educating people to the importance of this."*

In endorsing this viewpoint expressed by Bill McElroy I think this Association must take the lead in vigorously bringing to public attention the ongoing relationship of science, with all its complexities, to the problems man faces today, and will face in the future, in his pursuit of a life of quality and dignity.

Future Looks Bright

Most scientists are well aware of this relationship on the level of their own specialty. Those of us who have been privileged to work in the scientific community in Washington, D.C., know that this relationship pervades all the work of government. We have discovered that every government agency is in some measure a scientific agency, that even the deliberations and decisions of Congress are increasingly dependent on scientific data and that the "Scientific Society" in which we all live is no mere cliche but a fact to be recognized and a system to be reckoned with.

Furthermore, I think most of us are convinced that such a society, attacked by its critics as a "mindless machine," is that only to the extent that it is run by mindless men. For the most part, and for all the discontinuities between our technologies and our institutions I mentioned before, we have gotten no more or no less than we deserve. Modern civilization is what human drives have made it. Human drive can and will continue to change it. And I contend that for all the problems we see, for all the shortcomings we have and for all the difficulties we face, that man is far better today than ever before and his condition as well as that of the world he lives in will improve greatly as we move on to the 21st Century.

What are some of the reasons for my optimism? What can we look forward to and work towards? And why does science still provide essentially an Endless Frontier?

*See *Science Policy Bulletin,* v. 3, no. 6, December 1970, Abstract 1060.

First of all, I believe that the current anti-science, anti-technology and anti-rational attitude will run its course. And it will do so mainly through the realization that science and reason are essential to the pursuit of the goals and values of those very people who seem to deny this today. Those who want to reduce human deprivation and suffering, those who want to provide more opportunity for human freedom and creativity, and those who want to see a harmonious community of nations and people who share an abundance taken neither at the expense of others nor stripped destructively from nature – they will realize that such conditions can only be arrived at by giving their high ideals and zeal the power that lies in science and reason. If there is developing through the youth of America a "Consciousness III," as Charles Reich and others claim, its new outlook on the human condition will only be translated from an amorphous dream to reality as it turns to the wise use of the human intellect and the tools it has created.

The idea also that there exists, or is growing, a "counter culture" that can operate primarily on an emotional level, devoid of reason, will soon fade too, or be absorbed into a broader new outlook on humanity. And it would do so sooner if we would expose the myth that reason and emotion are two mystiques that cannot or should not co-exist. We know that there is no inherent dichotomy between the thinking and feeling man. We know that those who seek to explore and understand life are still capable of living and loving it – as well as more able to provide others with an opportunity to live a life that can be enjoyed.

We in the scientific community would also do well to revitalize the notion of the wonder and beauty of science – for science is an emotional as well as an intellectual endeavor – and to stress the excitement of unraveling the mysteries of nature and the challenge of working with its forces to better the condition of man and his planet.

I think the coming years will see science and technology talking back to its critics and speaking in actions that prove they are doing far more than righting past wrongs and adjusting the imbalances caused by man's technological excesses or indiscretions.

These years should see us making progress toward population control and distribution by combining new knowledge and techniques gained through the biological and social sciences.

They should see us solving environmental problems by resolving conflicts of economic growth and environmental impact, by gaining the knowledge and technology to extract, use and recycle resources with minimum ecological impact.

They should see us applying new systems approaches to urban development, to transportation, to health care, education and the production and distribution of goods and services – systems based on a better understanding of human behavior and human needs and on principles of aesthetics as well as efficiency.

And they should see us diminishing the basis for human aggression and violence, and uplifting man around the globe by disseminating the information and tools of development needed by all, and by sharing an abundance gained by the cooperation of all at the expense of none.

If all this seems like an impossible task or one that will require many decades, let me agree to the extent that it will be long and difficult. But whoever imagined it would be easy? As President John F. Kennedy once said, "Why is everyone so tired? The struggle won't be over in this century."

Changes in Government Science Management Foreseen

The coming years will also see the close relationship between science and government find a new maturity. I would venture to say that there are going to be many changes in the executive departments in realigning functions and responsibilities in scientific and technological areas. President Nixon's establishment of the Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Agency (NOAA) is just the beginning of the formation of new administrative bodies that will reflect new ways for the Federal Government to examine and manage scientific and technological problems or those related to them. I think we might expect to see such offices as a Federal Energy Agency, a Natural Resources Administration, a National Urban and Industrial Development and Relocation Agency, a U.S. Scientific and Technical Information Bank or any number of variations on these or similar ideas. Those of us working in Washington know that these are not far-out ideas, as legislative proposals along these lines cross our desks almost every week.

Congress is also due to see many new groups springing up in its own halls related to the role and control of science and technology. A score of committees and subcommittees already hold hearings on matters related to space, computers, basic research, super-sonic air travel, nuclear energy and every aspect of the environment. Resolutions have passed both Houses for a Joint Committee on the Environment and we may someday see a Joint Committee formed to evaluate the projected effects and side-effects of new technologies, as "Technological Assessment" has long been a household word in Congress. From my own experiences on "The Hill" I can assure you that we are getting an increasing number of legislators who are doing their science homework and this, I believe, will strengthen the science-government partnership in the future.

Frontiers Still Endless

I think it is important to stress one thing as we approach the midway point between Vannevar Bush's statement of 25 years ago and the end of this century, and that is that we are now in an era when we have achieved almost a universal awareness of the major problems that must be solved by man in the coming decades. Moreover, we have almost crystallized those problems so that there is a broad consensus on their nature and scope, on their relationships and on the urgency with which they must be dealt. (I will not list those problems as they have been well delineated and discussed at the many meetings of this AAAS Conference, which has been one of our most important and impressive conferences in my memory.) What is most vital now is that we bring back to our scientific community, to the government and to the public, the spirit that imbued Vannevar Bush. We must reconvince ourselves that the frontiers of science are still endless and that our physical frontiers – the great potentials for man and mankind – are not closed as long as we recognize and combine the new frontiers of the human mind and the human heart.

As this outlook session and this conference draw to a close I believe we should draw new courage and new confidence from what has been said. We have seen that science is still a most vital human enterprise. We have seen that it is central to all that man strives and hopes for. We have seen that, for all its immediate difficulties, it is alive and well and dedicated to serving and advancing mankind. The frontiers are still endless and science is still our most visionary and intrepid pioneer.

Current Literature

ALASKA PIPELINE

1. **Dingell, J. D., "Alaska Oil Pipeline",** *Congressional Record,* **v. 117, no. 5, 26 January 1971, pp. E233-E234.**
   Discusses national-security aspects of the Alaska pipeline and the damage it would do to the Alaskan environment; includes text of an advertisement and an editorial from the *Christian Science Monitor* which present different viewpoints.

2. **"Only Half the Pipeline Facts",** *Congressional Record,* **v. 117, no. 14, 9 February 1971, p. E593.**
   An article from the Detroit Free Press criticizes the Department of Interior's performance in establishing environmental safeguards in the case of the proposed pipeline for Alaska; it states that Interior has not been very forthright about the purpose of the line and recommends full understanding and discussion.

3. **Sage, B., "Will the Alaska Pipeline be Built?",** *New Scientist and Science Journal,* **v. 49, no. 738, 11 February 1971, pp. 294-295.**
   Reports that hearings will be held in February 1971 on a permit for the trans-Alaska oil pipeline – the Alyeska Pipeline Service Company is the group responsible for its construction; a great deal of research has been carried out on the environmental aspects of the pipeline proposal and further research is needed.

4. **Aspin, L., "The Proposed Alaskan Pipeline: Native Alaskan Interests",** *Congressional Record,* **v. 117, no. 18, 18 February 1971, pp. E893-E902.**
   Includes Congressman Les Aspin's statement before Interior Department hearings on the proposed trans-Alaska pipeline, his main concern being how it would affect the native Alaskans; also a report by several Interior Department officials dissenting from the Department's draft impact statement.

5. **Aspin, L., "Alaskan Native Concerns – II",** *Congressional Record,* **v. 117, no. 19, 19 February 1971, pp. E941-E943.**
   Contains statements by Chief Richard Frank of the native village of Minto, Alaska, who testified before the trans-Alaska pipeline hearings, and of David Wolf, an Alaska legal services attorney; these offer insight into native concerns about the proposed pipeline.

6. **"The Alaska Pipeline: An Interview",** *Congressional Record,* **v. 117, no. 24, 26 February 1971, pp. S2101-2104.**

   A series of articles is reprinted from the Seattle Times; includes an exclusive interview with Edward L. Patton, Alyeska Pipeline Service Co. president; topics discussed include the company's pledge to protect the environment, the cost of the pipeline, the expense of the long delay in building, and the hiring of Alaska natives for pipeline jobs.

ANTARCTICA

7. **Smith, P. M. (Special Editor), "Antarctica Since the IGY", Special Edition of the** *Bulletin of the Atomic Scientists,* **v. 26, no. 10, December 1970, 104 pp. (Available from Bulletin of the Atomic Scientists, Circulation Dept., 935 E. 60th St., Chicago, Ill. 60637. Price: $1.35.)**

   Entire issue consists of papers by different authorities: a descriptive introduction (2 papers); Political Laboratory (4 papers); Science Laboratory (6 papers); Management and Development (4 papers); the The Next Decades (2 papers).

AUSTRALIA

8. **"Australia Enters the Atomic Age",** *Nature,* **v. 228, no. 5277, 19 December 1970, p. 1132.**

   Reports construction of the first commercial nuclear reactor in Australia at Jervis Bay in New South Wales; advances made by Australian research teams are reported by the Australian Atomic Energy Commission.

BIOLOGICAL SCIENCES

9. *The Life Sciences,* **A Report of the Committee on Research in the Life Sciences, Committee on Science and Public Policy, National Academy of Sciences, 1970, 525 pp. (Available from Printing and Publishing Office, National Academy of Sciences, 2101 Constitution Ave., N.W., Washington, D.C. 20418. Price: $10.50.)**

   Discusses the state of U.S. biomedical sciences, including population, environment, medicine and health, biological research, and marine biology; includes specific recommendations by the 29-man committee based on findings from 22 panel studies and 25,964 questionnaires regarding priorities, goals, and research in the life sciences; has 180 contributors.

10. **Schatz, G. S., "Bioscience and Government: Problems of Organization, Support",** *News Report,* **NAS/NRC/NAE, v. 20, no. 10, December 1970, pp. 1, 3-4.**

    Reviews remarks by President Handler of the National Academy of Sciences at November 30 press conference, where he announced that the NAS Committee on Research in the Life Sciences had completed its survey on the state of U.S. biomedical science;

discusses recommendations in the committee's report (see Ref. 9) regarding government support of biomedical activities.

11. **"Transfer Delayed; Ft. Detrick's Uncertain Fate",** *Science News,* **v. 99, no. 4, 23 January 1971, p. 64.**
    Describes attempts by DoD and HEW to obtain permission and funds for converting Ft. Detrick, no longer needed for bacteriological-weapons research, to a biomedical-research facility under NIH.

12. **Boffey, P. M., "Fort Detrick: A Top Laboratory is Threatened With Extinction",** *Science,* **v. 171, no. 3968, 22 January 1971, pp. 262-264.**
    Reviews considerations regarding the fate of the Army's sophisticated microbiological-research facility, Fort Detrick, which appears headed for shutdown as a result of U.S. renunciation of offensive biological warfare, and which no other agency seems to be willing to take over.

BUDGET FOR SCIENCE AND TECHNOLOGY – ADMINISTRATION REQUEST

13. **"Federal Budget Digest",** *Washington Science Trends,* **v. 25, nos. 17-18, 1-8 February 1971, pp. 97-108.**
    Breaks down the Nixon Administration FY 1972 Budget requests for R&D and discusses increases for NSF, DoD, environment, biomedical research, Interior Department, Agriculture, Justice, Transportation, Commerce, and marine sciences; decreases for AEC and HUD; little change for space.

14. *Science & Government Report,* **no. 2, 15 February 1971, 6 pp.**
    Discusses aspects of Nixon's FY 1972 budget request related to science and technology, including the substantial increase for defense R&D, decreases in support for training in science and engineering; discusses the House Science Subcommittee under its new chairman Davis; reports on the January 28 press budget briefing by presidential science adviser David.

15. *Science & Government Report,* **no. 1, 1 February 1971, 6 pp. (Available by subscription from P.O. Box 21123, Washington, D.C. 20009. Price: $25/24 issues.)**
    Includes discussions of the philosophy and implications of Nixon's proposal to provide an added $100 million for the National Science Foundation and $100 million for cancer research; his proposal to revamp the Federal cabinet-level department structure; and the expected negative report by a study group of the National Academy of Sciences on the proposed expansion of New York's Kennedy Airport.

16. **" '72 Budget: Nixon Proposes Modest Increases for Science",** *Science,* **v. 171, no. 3970, 5 February 1971, pp. 459-460.**
    Summarizes agencies and programs given priority in the FY 1972 Presidential budget request (NSF, cancer, environment, highway safety, air traffic, crime, and defense); speculates on Congress' reactions in the face of its heavy slate of unresolved issues and the 1972 presidential election.

17. **Greenberg, D., "Nuclear Standoff Triggers New Boom in Defence Research",** *New Scientist and Science Journal,* **v. 49, no. 738, 11 February 1971, p. 307.**

    Discusses the science and technology budget which President Nixon has sent to Congress; reports a vast increase in spending for military R&D, moderate increases for nonmilitary R&D, especially in socially relevant fields, and a decision to end support for expansion of graduate science education; a table shows amounts allotted by department or agency.

18. **"To be First in Everything; President Nixon's New Budget Contains Good News for a Worried Scientific Community",** *Science News,* **v. 99, no. 6, 6 February 1971, pp. 93-96.**

    Describes the R&D funding recommendations in the FY 1972 budget proposal, showing breakdowns for research, development, colleges and universities, government agencies, and specific disciplines; compares these figures with those for previous years.

BUDGET FOR SCIENCE AND TECHNOLOGY – FEDERAL R&D

19. **March, M. S.,** *Federal Budget Priorities for Research and Development,* **The University of Chicago Center for Policy Study, 1970, 45 pp. (Available from The University of Chicago Center for Policy Study, 5801 Ellis Ave., Chicago, Ill. 60637. Price: $1.50.)**

    Presents a detailed analysis of Federal funding for R&D showing trends since 1950, with breakdowns according to department or agency, type of performer, type of research, field of science, state, and manpower utilization; includes a discussion of issues and priorities for the 1970's, along with some forecasts; author is a senior officer of the Bureau of the Budget; report has 14 tables and 7 charts.

20. *Federal Funds for Research, Development, and Other Scientific Activities, Fiscal Years 1969, 1970, and 1971,* **Surveys of Science Resources Series, National Science Foundation, Report NSF 70-38, v. XIX, September 1970, 264 pp. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: $2.00.)**

    Reports R&D obligations by agency and agency subdivision, character of work, performers, and distribution of research funds by fields of science; also provides data on R&D plant, on scientific and technical information activities, general-purpose scientific data, and distribution of R&D funds by states; text and 5 appendixes contain numerous charts and tables.

21. *Federal Support of Applied Research,* **Report of the Ad Hoc Task Force on Roles of the Federal Government in Applied Research, Submitted by the Committee on Public Engineering Policy of the National Academy of Engineering to the National Science Foundation, 1970, 16 pp. (Available from the National Academy of Engineering, 2101 Constitution Ave. N.W., Washington, D.C. 20418.)**

    Defines applied and basic research and recommends organizational changes in NSF to fill its new mandate to support applied research; discusses augmentation of NSF budget and division of funding between basic and applied research.

22. *Federal Support to Universities, Colleges, and Selected Nonprofit Institutions, Fiscal Year 1969,* **A Report to the President and Congress, National Science Foundation, Report NSF 70-27, August 1970, 175 pp. (Available from the U.S. Government Printing Office, Washington, D.C. 20402. Price: $1.00.)**

Discusses support to universities and colleges by category (R&D, R&D plant, other science, nonscience), year (FY 1963 through 1969), geographical location (region), state, agency source of funds, individual institutions (showing top 100 recipients), and number and type of degrees awarded; text contains 30 tables and 3 charts; 3 appendixes contain 11 large tables.

23. **"Shopping List for the NSF",** *Nature,* **v. 229, no. 5284, 5 February 1971, p. 367.**

Summarizes the breakdown of the estimated $622 million FY 1972 funding for NSF; major items are $258 million for individual research projects, $167 million for 8 national and special research programs, and $40 million for 5 national research centers; postdoctoral fellowships and university science development programs ($22 million in FY 1971) have been eliminated altogether.

BUDGET FOR SCIENCE AND TECHNOLOGY – INDUSTRY R&D

24. **"Industrial R&D Spending, 1969",** *Science Resources Studies Highlights,* **National Science Foundation, 22 January 1971, Report NSF 70-47, 4 pp. (Available from Office of Economic and Manpower Studies, Division of Science Resources and Policy Studies, National Science Foundation, Washington, D.C. 20550.)**

Breaks down industrial R&D expenditures by year, source of funds (government or company), industry, fraction of net sales in each industry, type of research (basic, applied, development), and cost per R&D scientist or engineer as a function of year (1957 through 1969).

25. *Research and Development in Industry, 1968: Funds, 1968; Scientists and Engineers, January 1969,* **Surveys of Science Resources Series, National Science Foundation, Report NSF 70-29, July 1970, 110 pp. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: $1.00.)**

Presents results of a Census Bureau survey of industrial R&D for 1968 broken down by performer and source of funds (industry, universities, Federal government, and nonprofits); type of industry; geographic location; type of costs (wages, materials, other); includes average salary of scientists and engineers in selected industries and number of R&D scientists and engineers per 1000 workers; contains 10 charts, 56 tables, and 2 appendixes.

CANADA

26. **Bertin, L., "Science Policy in Canada",** *Technology Review,* **v. 73, no. 4, February 1971, pp. 35, 37-39.**

Reports findings of a recent O.E.C.D. mission making a national science policy study of Canada, "a huge, rich and empty country"; discusses Canada's economic and scientific development, the dependency of Canadian industry on foreign capital, and proposals for improving the administration of science.

27. *A Science Policy for Canada,* **Report of the Senate Special Committee on Science Policy, Volume I, "A Critical Review: Past and Present", Queen's Printer for Canada, Ottawa, 1970, 327 pp.**

    Discusses the Senate Inquiry into Canadian R&D and science policy, the history of science policy in Canada, the roles of government, university, and industry, and the need for an overall science policy; Vol. II, expected later this year, will contain Committee recommendations for reorganizing the management of science and technology in Canada.

28. **Mardon, J., et al.,** *Analysis of Briefs Submitted to the Senate Committee on Science Policy, 1968-1969,* **August 1970, National Business Publications, Ltd., Gardenvale, Que., Canada, 73 pp. ($5.00).**

    Analyzes and summarizes 320 briefs submitted to Canada's Special Senate Committee on Science Policy under the headings Education, Information, Communications; The Role of Government; The Role of Industry; The University; Research and Technology; Scientists and Manpower; Funds and Budgeting; and Recommendations for a Science Policy.

29. **"Who Should Make Science Policy?", and "The Lamontagne Report: Science Policy in Canada is a Legacy of Failures",** *Science Forum,* **v. 4, no. 1, February 1971, pp. 2-4.**

    Discusses the content and significance of the report of the Canadian Senate special committee on science policy (see Ref. 27); two editorials.

30. **Crowther, J. G., "Academic Science in Canada",** *New Scientist and Science Journal,* **v. 49, no. 739, 18 February 1971, p. 341.**

    Discusses a report on "Federal Support of Universities and Colleges of Canada", by W. J. Waines (published in 1970 by Association of Universities and Colleges of Canada, 151 Slater Street, Ottawa 4, Canada, $3.00); Professor Waines analyzes the problems of financing and developing academic science in Canada.

CHILE

31. **"Astronomy in Chile",** *Nature,* **v. 229, no. 5283, 29 January 1971, p. 294.**

    Reports major astronomical observatories are being constructed in the Chilean Andes by at least five foreign groups; the Carnegie Institution, Washington, D.C., will build a 100-inch telescope at Las Campanas; there is little danger that the Chileans will nationalize telescopes.

CHINA

32. **Wu, Y., and Sheeks, R. B.,** *The Organization and Support of Scientific Research and Development in Mainland China,* **published for the**

National Science Foundation by Praeger Publishers, New York, 1970, 593 pp. ($17.50).

Covers life sciences, physical sciences, and engineering sciences; discusses history, policy formulation, trends in R&D, financing R&D, institutions, manpower, and relation to economic growth; contains 9 chapters, 62 tables, 7 figures, and 4 appendixes.

33. **Orleans, L. A., and Suttmeier, R. P., "The Mao Ethic and Environmental Quality",** *Science,* **v. 170, no. 3963, 11 December 1970, pp. 1173-1176.**

    Describes Communist China's government-dictated fetish for waste recycling and environmental concerns dating back 20 years; presents reasons for this attitude and some current problems.

DEVELOPING COUNTRIES

34. **"Science in Underdeveloped Countries: World Plan of Action for the Application of Science and Technology to Development",** *Minerva,* **v. 9, no. 1, January 1971, pp. 101-121.**

    Starts with the premise that science and technology are necessary for development and discusses the indigenous capacity for science and technology in developing countries, problems of access to world science and technology, and recommendations for actions by both the developed and developing countries for most effective coupling of scientific activities.

35. **"Science in Developing Countries": (1) Ziman, J., "Three Patterns of Research in Developing Countries"; (2) Pereira, H. C., "The Integration of Research Agencies for African Agricultural Development"; (3) Osborne, D., "The Use and Promotion of Science in Developing Countries"; (4) Moravcsik, M., "Some Modest Proposals",** *Minerva,* **v. 9, no. 1, January 1971, pp. 32-65.**

    These four papers discuss a range of problems related to advancing research in underdeveloped countries.

36. **Sabato, J. A., "Quantity Versus Quality in Scientific Research (I): The Special Case of Developing Countries",** *Impact of Science on Society,* **v. 20, no. 3, July-September 1970, pp. 183-193.**

    Discusses "the bitter ironies of research in developing countries: research centres are provided with ample funds until they start becoming productive . . . and then the supply is sharply reduced; research centres tend to reinforce the brain drain by driving out their best scientists, making up for them with large numbers of inferior men . . . proposes changes that will augment both quantity and quality of research" in developing countries.

37. **Turnham, D., "The Employment Problem in Less Developed Countries",** *The OECD Observer,* **no. 49, December 1970, pp. 6-10.**

    Outlines the results of the first study of a series planned by OECD's Development Centre to investigate the problem of widespread shortage of jobs at adequate income levels in many poor countries where economic development is proceeding at unprecedented rates.

38. **Henderson, G.,** *Emigration of Highly Skilled Manpower from the Devel-*

oping Countries, **UNITAR Research Report No. 3, 1970, 213 pp. (Available from United Nations Institute for Training and Research, 810 U.N. Plaza, New York, N.Y. 10017. Price: $1.00.)**

Discusses the size, character, and causes of the movement of trained personnel from developing to developed countries, specific countries from which this flow occurs and to which it proceeds, and the implications of this migration to both losing and receiving countries; contains 9 chapters, 16 tables, 3 graphs, bibliography, and country index.

39. **Parthasarathi, A., "Brain Drain from Developing Countries",** *Nature,* **v. 230, no. 5289, 12 March 1971, pp. 87-90.**

Discusses the loss of scientific and technical manpower from the developing countries; analyzes the reasons, using India as a frequent example; and suggests measures for tackling the problem.

EDUCATION

40. *Graduate Student Support and Manpower Resources in Graduate Science Education, Fall 1969,* **Surveys of Science Resources Series, National Science Foundation, Report NSF 70-40, September 1970, 84 pp. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: $1.00.)**

Summarizes statistical data on graduate enrollment in the sciences (including engineering), types and sources of major support of full-time graduate students in doctorate departments, postdoctorals, and graduate faculty as of fall 1969 in doctorate-granting institutions applying for traineeship grants from the NSF for 1970; text includes 15 charts and 14 tables; there are 5 appendixes.

41. **Bazell, R. J., "Graduate Support: NIH Grants Threatened by Nixon Priorities",** *Science,* **v. 171, no. 3971, 12 February 1971, pp. 554-556.**

Analyzes the Administration's Office of Management and Budget's belief that all graduate study can be best financed through loans and research grants and that the NIH training grant program should be axed, presumably to discourage production of new Ph.D.'s.

42. **Greenberg, D., "Time to Reshuffle the Pack?",** *New Scientist,* **v. 48, no. 728, 3 December 1970, p. 394.**

Discusses the possible future of NIRAS (the proposed National Institutes of Research and Advanced Studies) and the dangers involved in reorganizing the present system of U.S. science and higher education support.

43. *Impact of Changes in Federal Science Funding Patterns on Academic Institutions, 1968-70,* **National Science Foundation Report NSF 70-48, December 1970, 76 pp. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: 75 cents.)**

Presents findings from two NSF surveys of universities to ascertain changes in funding patterns over a 2-year period and their effects; discusses expenditures for science activities, budget categories affected, manpower changes, staff participation in research and teaching, curtailment of research projects and facilities, departments most seriously affected, policy changes, and major effects; contains 4 appendixes with numerous tables.

44. **"Sponsored Research: Harvard's Criteria",** *Nature,* **v. 229, no. 5279, 1 January 1971, p. 8.**

Lists six criteria adopted by Harvard University for support of research within the University by outside agencies; discusses freedom of research.

45. **"Engineering Degrees Register Increase for 1970", 11 December 1970, 3 pp. (Press release: available from Engineers Joint Council, 345 E. 47 St., New York, N.Y. 10017.)**

Shows that 7% more B.S.'s, 4% more M.S.'s, and 7% more Ph.D.'s in engineering were granted in 1970 than in 1969, with electrical, mechanical, and civil leading the way; a tabular breakdown by curriculum and degree is included.

46. **"Engineering – the Liberal Education of Tomorrow?",** *Chemical Engineering Progress,* **v. 67, no. 1, January 1971, p. 29.**

States that because of the increasingly technical aspects of our society, a greater number of young people will select an engineering education as a prerequisite to such careers as medicine, law, urban planning, public administration, and many others.

47. **"NSF Program on Public Understanding of Science",** *Chemical & Engineering News,* **v. 49, no. 4, 25 January 1971, p. 23.**

Announces issuance of NSF guidelines for project proposals in 3 areas: information projects on science for laymen; training programs, such as interdisciplinary programs related to science; and R&D programs, such as testing and evaluation of new approaches in public understanding of science.

48. **Dror, Y. (Ed.), "Universities and the Teaching of Policy Sciences – Part I",** *Policy Sciences,* **v. 1, no. 4, December 1970, pp. 401-482.**

This special issue consists of a prologue and five papers, each by a different author, covering various aspects of the role of universities in the teaching of policy sciences.

49. **"Specialized Courses",** *Chemical and Engineering News,* **v. 49, no. 2, 11 January 1971, p. 10.**

Reports that Intra-Science Research Foundation in Santa Monica, Calif., has initiated a Fellows Program "to provide to universities, institutions, and industrial laboratories a selected series of specialized courses"; this is an adaptable program planned to fit into the total efforts being made to modify and improve graduate science education.

50. **Jevons, F. R., "Problems Facing University Science",** *Nature,* **v. 229, no. 5287, 26 February 1971, pp. 601-602.**

Presents the author's reflexions on a conference on problems facing university science, organized by the British Council for Scientific Policy and held at the University of Manchester in January; points to some of the changes that may have to be made in university science departments to cope with the problem that their size is likely to grow faster than their finances.

51. **Valéry, N., "Austerity Ahead for University Research",** *New Scientist,* **v. 49, no. 734, 14 January 1971, pp. 61-62.**

Presents views expressed at the Conference on Problems Facing University Science, held at the University of Manchester in

January; gives reasons for the disenchantment with science which has led to cutbacks in growth of research funds; concludes that there needs to be less specialization at an early stage in university courses and that postgraduate courses should be related to real problems.

52. **"What Future for Higher Education?"** *Nature*, **v. 229, no. 5281, 15 January 1971, pp. 147-148.**
    Discusses the structure of British higher education, changes to be expected in the future, and problems; based on a conference on higher education in Cambridge.

53. **"Teaching without Research",** *Nature*, **v. 229, no. 5287, 26 February 1971, pp. 584-585.**
    Suggests that the changing pattern of financial support for scientific research at universities in Britain will eventually affect the character of university departments; some universities will be forced to concentrate on teaching.

54. **"Policies for Change",** *Nature*, **v. 229, no. 5287, 26 February 1971, pp. 587-588.**
    Discusses chief changes in the policy of the Chemistry Committee of the British Science Research Council which are likely to come about in the next few years; these are a halt in the rate of growth of research studentships in chemistry and more flexible postgraduate studies.

ENERGY CRISIS

55. *America's Energy Needs and Resources,* **Remarks of the Honorable H. M. Dole, Assistant Secretary for Mineral Resources, Department of the Interior, at Stanford University, 12 January 1971. (Reprint available on request from Information Officer, Department of the Interior, Washington, D.C. 20242.)**
    Warns against "an energy gap of major proportions" which short-range rescue efforts will not cure; outlines a long-range program of R&D as the only way of bringing about a satisfactory solution.

56. **Zimmerman, M. D., "Price of Progress: The Energy Famine",** *Machine Design,* **v. 43, no. 6, 4 March 1971, pp. 21-27.**
    Describes the current thin line between world power supply and demand, techniques being used to meet peak needs and to boost efficiency, prospects for increased fuel supplies, the outlook for nuclear power, and less conventional future possibilities (geothermal, solar, and tidal energy); calls for governmental policies and a nationally coordinated system of priorities that deal with the problems pragmatically.

57. **"Rep. Holifield Calls for Federal Power Policy Council",** *Atomic Energy Clearing House,* **v. 17, no. 7, 15 February 1971, p. 2.**
    Presents excerpts from Rep. Holifield's February speech before the National Rural Electric Cooperative Association, commenting on the absence of carefully worked out energy policies in the President's government reorganization proposals, and calling for the creation of a Power Policy Council in the Executive Office of the President.

58. **Mayer, L. A., "Energy Crisis",** *Fortune,* **v. 82, no. 5, November 1970, pp. 75-77, 159-166.**

Delves into the causes of the critical shortage of power and fuel that has already begun and is expected to continue for at least several years; predicts sharp increases in the cost of electricity; laments the lack of a coordinated national energy policy.

59. **McElheny, V. K., "Energy Shortage and Energy Choice",** *Technology Review,* **v. 73, no. 3, January 1971, pp. 12-13.**

Analyzes the American "energy crisis" historically and economically; suggests that it is possible to meet future high-energy, low-pollution requirements by keeping the energy sources competing vigorously to hold the price down, resulting in policies of "recycling just about everything that can be recycled", and striving for the utmost in waste heat and effluent control and in generating and transmitting efficiency.

60. **"The Energy Crisis",** *Congressional Record,* **v. 117, no. 3, 25 January 1971, p. S34.**

Presents a reprint of a *Washington Post* article, "Power Blackouts Still Threaten U.S.", by W. G. Cushing, carrying an analysis by J. N. Nassikas, chairman of the Federal Power Commission and including basic statistics on supplies of coal, oil, and natural gas; discusses some of the transportation and price problems contributing to the shortages.

61. **"America's Energy Needs and Resources",** *Congressional Record,* **v. 117, no. 4, 26 January 1971, pp. S279-S282.**

Contains reprint of a speech by H. M. Dole, Assistant Secretary of Interior for Mineral Resources, going into some detail on the fuels and energy situation and emphasizing the vital and immediate need for action by the Federal Government toward a realistic fuels and energy policy.

62. **"Electric Power Will Play Increasing Role in Providing Solutions to Many Pollution Problems",** *Congressional Record,* **v. 117, no. 17, 17 February 1971, pp. H676-H677.**

Contains excerpts from remarks by Rep. Holifield discussing the feasibility of providing power to meet the needs for the rest of this century without violating environmental standards, the urgent need for a national energy policy, the need to educate the public on the issues, the impracticality of all but nuclear-fission energy for fulfilling the needs, and the desirability of accelerating the development of breeder reactors.

ENERGY – ENVIRONMENT

63. *Electric Power and the Environment,* **A report sponsored by The Energy Policy Staff, Office of Science and Technology, in cooperation with various Government agencies, August 1970, 71 pp. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: 75 cents.)**

Presents the results of a study to develop a program for resolving the environmental problems in the siting of steam electric power plants and extra-high-voltage transmission lines; recommends a 4-part program; contains 7 chapters and 4 appendixes.

64. ***The Economy, Energy, and the Environment*, a background study prepared for the use of the Joint Economic Committee, Congress of the United States, by the Environmental Policy Division, Legislative Reference Service, Library of Congress, 1 September 1970, 131 pp. (For sale by the U.S. Government Printing Office, Washington, D.C. 20402. Price: 55 cents.)**

Reviews the energy picture in the U.S., current needs and problems, forecasts, nuclear- and fossil-fuel supplies, and the environmental consequences of energy conversion.

65. **Lessing, L., "New Ways to More Power with Less Pollution", *Fortune*, v. 82, no. 5, November 1970, pp. 78-81, 131-137.**

Suggests that projected power demands might be achievable without destroying the environment simply by replacing our inefficient fossil-fired steam power plants with some far more efficient source; possibilities cited include magnetohydrodynamics, solar power, and superconductivity (for transmission).

66. **"The Energy Frontier", *Technology Review,* v. 73, no. 2, December 1970, p. 60.**

Quotes Prof. N. H. Brooks, Environmental Science and Civil Engineering Dept. at Cal. Tech, that, even though we may have enough fuel, energy use will ultimately have to be limited because of unavoidable environmental impact.

67. **Mills, G. A., Johnson, H. R., and Perry, H., "Fuels Management in an Environmental Age", *Environmental Science and Technology,* v. 5, no. 1, January 1971, pp. 30-38.**

Discusses the new criteria for fuels selection, based on environmental awareness, that are replacing the old idea that cheapest is always best; outlines the impacts on land, water, and air resources caused by the various energy sources (coal, uranium, oil, natural gas, and hydro); discusses ways of minimizing the impacts.

68. **"Prompt Action Required to Protect Environment as Need for Electric Energy Grows", *Congressional Record,* v. 116, no. 203, 17 December 1970, pp. H11927-H11928.**

Congressman Fascell discusses his proposals for (1) a 10-year projection of environmental disruption by power plants and (2) coordination of Federal, state, and local regulatory activities; endorses OST recommendations (see Ref. 63); deplores CEQ's decision to withhold environmental-impact reports from the public on Federal projects until after the projects have been authorized.

ENERGY – GEOTHERMAL STEAM

69. ***Geothermal Resource Development*, Report from the Committee on Interior and Insular Affairs, To accompany S.368, 4 September 1970, 30 pp. (May be obtained on request by sending a self-addressed gummed label to U.S. Senate Document Room, Washington, D.C. 20510.)**

Explains geothermal power and the background and provisions of S.368 authorizing the Secretary of the Interior to make disposition of geothermal resources; presents correspondence reflecting opinions and recommendations concerning the bill; and reproduces an environmental-impact statement submitted in conformance with the National Environmental Policy Act of 1969.

70. *Geothermal Steam and Resources,* **Hearings Before the Subcommittee on Minerals, Materials, and Fuels of the Committee on Interior and Insular Affairs, U.S. Senate, 91st Congress, Second Session, on S.368, July 17 and 28, 1970, 140 pp. (Available from U.S. Senate, Interior and Insular Affairs Committee, Washington, D.C. 20510.)**

    Presents the text of the bill authorizing the Secretary of the Interior to make disposition of geothermal resources, testimony and communications from assorted individuals and organizations, and pertinent additional information (e.g., results of energy-demand studies, environmental impact statement, reprint of an article from *Electrical World* discussing geothermal power, and location of resources).

71. **Packwood, R. W., "Introduction of a Bill to Promote the Exploration and Development of Geothermal Resources",** *Congressional Record,* **v. 117, no. 10, 3 February 1971, pp. S757-S758.**

    Gives the text of S.564, a sequel to the act passed by the previous Congress; proposes a 5-year program to assess the geothermal energy resources of the public domain, study factors governing occurrence of geothermal reservoirs, develop guides to exploration, and help develop the technology of geothermal-power generation and by-product recovery; reprints an article, "Geothermal Energy Looms as Economic Factor".

72. **Lear, J., "Clean Power from Inside the Earth",** *Saturday Review,* **5 December 1970, pp. 53-61.**

    Discusses the geothermal resources in the Mexicali Valley of northwestern Mexico and their exploitation by Mexico's Federal Electricity Commission; describes the activities of Dr. R. W. Rex at California's Riverside campus in studying and promoting the use of geothermal energy in the U.S. Southwest; covers other current and potential applications of geothermal heat in the U.S.

73. **Large, A. J., "'Free' Electricity: A Plan to Get Energy from Heat Inside Earth Moves Forward a Bit",** *The Wall Street Journal,* **10 December 1970, pp. 1, 14.**

    Describes the concept of electricity from geothermal steam, with emphasis on the legal complexities of permitting exploitation of geothermal resources and snags encountered in passage of Sen. Bible's Geothermal Steam Act of 1970.

74. *Natural Steam for Power,* **a brochure prepared by the U.S. Geological Survey from material provided by D. E. White, 1969. (Available on request from the U.S. Department of the Interior, Geological Survey, Washington, D.C. 20242.)**

    Discusses sites for geothermal exploration, geothermal sources for commercial steam, types of geothermal fields, and the potential of geothermal power.

ENERGY – NUCLEAR

75. **Robbins, C., "Nuclear Industry Issues and Objectives",** *Nuclear Engineering International,* **v. 15, no. 174, November 1970, pp. 905-906.**

Calls attention to the fact that the shortage of fossil fuels has stimulated a new rush toward nuclear generating capacity, and discusses the current situation regarding public acceptance and economics of the nuclear industry.

76. **Inglis, D. R., "Nuclear Energy and the Malthusian Dilemma",** *Bulletin of the Atomic Scientists,* **v. 27, no. 2, February 1971, pp. 15-18.**
    Questions claims that today's nuclear power is clean, dependable, economic, and safe; recommends increased emphasis on future-oriented R&D (breeders) instead of prematurely proliferating current designs (water reactors); suggests meeting current needs by exercising restraint in energy demands and settling for a less rapidly expanding economy.

77. **"Conserving Feedstocks",** *Chemical & Engineering News",* **v. 49, no. 3, 18 January 1971, p. 8.**
    Gives highlights of a talk by S. D. Freeman, director of the energy policy staff of the Office of Science and Technology, who indicated that national energy policy is set by environmental quality laws and that nuclear power is preferred from this standpoint; discusses opposition to nuclear power plants and new legislation to be proposed on siting.

78. **"The Need for a Comprehensive Energy Program and Comments on the Breeder Program",** *Congressional Record,* **v. 116, no. 204, 18 December 1970, pp. E10516-E10519.**
    Reprint of a talk given to the Atomic Industrial Forum by Chairman C. Holifield of the Joint Committee on Atomic Energy covering two major themes: (1) some extremist views about environmental considerations and (2) the need to get on with our national program to bring into being breeder reactors.

79. **Seaborg, G. T., "On Misunderstanding the Atom", Remarks presented at the National Press Club Luncheon, Washington, D.C., March 22, 1971,** *AEC News Release,* **v. 2, no. 12, 24 March 1971, pp. 2-6.**
    Discusses the answers to 3 questions: Do we need all that power? If so, why should it be nuclear? If nuclear, can we have it safely? Predicts that "by the year 2000, we will see about 1000 million kilowatts of electricity generated by about 1000 nuclear power reactors, sharing about half the nation's power load, with highly improved fossil fueled plants carrying the other half".

ENVIRONMENTAL AGENCIES

80. **Ehrlich, P. R., and Holdren, J. P., "Dodging the Crisis",** *Saturday Review,* **7 December 1970, p. 73.**
    Discusses the inherent weakness of the Council on Environmental Quality because of its limiting connection with the White House; notes that the first annual report of the CEQ is an indication of it's helplessness.

81. **"Industry Leaders Hunt: Practical Answers to Pollution",** *Nation's Business,* **v. 59, no. 1, January 1971, p. 18.**
    Discusses the job facing top business executives appointed to the National Industrial Pollution Control Council by President Nixon

and the 30 subcouncils set up by the Council. The theory behind the Council is the "peer pressure system" of forcing industry to work with the government and the public in solving its own problems.

82. **"Industry Council Rebuts Pollution Control Trends", *Industry Week,* v. 168, no. 8, 22 February 1971, pp. 13-14.**

    The President's National Industrial Pollution Control Council is alarmed at the views which put the burden of proof on industry on the basis that such approaches will hinder free competition and innovation.

83. **"What's the U.S. Army Doing in Water Pollution Control?" *Environmental Science & Technology,* v. 4, no. 12, December 1970, pp. 1101-1102.**

    Army Corps of Engineers has expanded jurisdiction under the National Environmental Policy Act of 1969. New role extends their permit-granting authority over all discharges and deposits into navigable U.S. waters. The Corps "will concentrate on major sources of industrial pollution".

84. **"Initial NOAA Lineup May Endure", *Oceanology International,* v. 5, no. 12, December 1970, p. 10.**

    Presents an organization chart showing the various offices, services, and laboratories and gives names and responsibilities of 17 top officials.

85. **"The National Oceanic and Atmospheric Administration", *Congressional Record,* v. 117, no. 11, 4 February 1971, pp. S841-S844.**

    Presents the manuscript of a speech, "NOAA – A New Concept", delivered to the American Oceanic Organization by Dr. R. M. White, Administrator-Designate of NOAA, giving a detailed summary of the organization, capabilities, and aspirations of NOAA.

86. **Siciliano, R. C., "One League Past the Crossroads", *Congressional Record,* v. 117, no. 5, 27 January 1971, pp. E238-E239.**

    Deals with the functions and responsibilities of the newly created National Oceanic and Atmospheric Administration within the Department of Commerce; lists three ways in which government and industry must interact for effective development of marine resources; article appeared in the *Manager,* a Commerce publication.

87. **"Center Will Study Global Ecology", *Chemical & Engineering News,* v. 49, no. 5, 1 February 1971, p. 40.**

    Announces the filing of incorporation papers by the Inter-American Institute of Ecology (IAIE), with plans to begin operations July 1 with funds to be raised "from federal, state, and local governments and industry"; staff is expected to number 150 scientists plus support, and studies will be multidisciplinary in such areas as global biospheric processes, large-scale ecosystems, environmental policy, ecological forecasting, and planning.

88. **"International Institute for Environmental Affairs Formed", Press Release by Aspen Institute for Humanistic Studies, 600 Fifth Ave., New York, N.Y. 10020, 10 January 1971.**

    Provides a detailed account of the organization, funding, operation, and key personnel in the IIEA, an independent service organization set up to assist institutions throughout the world that are concerned with environmental policies and action; announces the first annual 10-week international institute to be held this summer at Aspen, Colorado, with a focus this year on preparation for the 1972 Stockholm World Conference.

89. **"Pollution in Its Place"**, *Nature*, v. **229, no. 5287, 26 February 1971, pp. 683-684.**
   Discusses the first report of the British Standing Royal Commission on Environmental Pollution as a framework for the approach to pollution; points out also the need for improvement in quality of life.

90. **"Pollution Agencies Catch on in Europe"**, *Chemical and Engineering News*, **v. 49, no. 8, 22 February 1971, p. 28.**
   Reports that Great Britain and France have recently set up single government ministries to tackle pollution problems; other West European countries may soon follow; major problems are discussed.

ENVIRONMENTAL LEGISLATION

91. *Congress and the Nation's Environment: Environmental Affairs of the 91st Congress*, **Prepared by the Environmental Policy Division, Congressional Research Service, Library of Congress, at the request of H. M. Jackson, Chairman, Committee on Interior and Insular Affairs, U.S. Senate, 10 February 1971, 288 pp. (Available from The Committee on Interior and Insular Affairs, U.S. Senate, Washington, D.C. 20510.)**
   Presents an analysis of environmental legislation passed in both sessions of the 91st Congress, along with summaries of major reports and highlights of significant events associated with the congressional action; broken down by numerous subject categories.

92. **"The President's Message on the Environment"**, *Congressional Record*, **v. 117, no. 21, 23 February 1971, pp. S1767-S1768.**
   Presents a summary of the President's environmental proposals: National land-use policy, coastal wetlands, open spaces and parks, powerplant siting, historic preservation and rehabilitation, water pollution legislation, pesticides, noise, and ocean dumping.

93. **Holden, C., "Nixon Offers Large, Mixed Bag on Environment"**, *Science*, **v. 171, no. 3972, 19 February 1971, p. 659.**
   Describes the Administration's environmental proposals to Congress and discusses the chances for congressional approval of some of the 14 pieces of new legislation required for their implementation.

94. **"Congress Faces Wide Array of Ecology Bills"**, *Chemical & Engineering News*, **v. 49, no. 8, 22 February 1971, pp. 33-34.**
   Discusses the variety of bills facing the 92nd Congress: specifically, the bills having to do with water and air pollution, pesticide curbs, and ocean dumping.

95. **"Congress Makes Further Progress on Antipollution Legislation",**

Environmental Science & Technology, **v. 5, no. 1, January 1971, pp. 26-28.**

Discusses new laws – solid waste, water, air, education act, and appropriations – enacted by the lame-duck session which indicate that Congress is "paying more than lip service to environmental improvement".

96. **"Action Toward Cleaner Air",** *Science News,* **v. 99, no. 2, 9 January 1971, pp. 22-23.**

    Briefly describes provisions of the 1970 Clean Air Act, just signed into law, and calls attention to EPA's task of setting national standards.

97. **"Clean Air Laws Balance Health, Economy",** *Chemical & Engineering News,* **v. 48, no. 53, 21 December 1970, p. 34.**

    Discusses the problems of balancing clean-air laws with economic growth, as presented at the Second International Clean Air Congress in Washington, D.C. Twelve countries participated in the Congress and a table presents briefly the type of pollution legislation for the participating countries.

98. **"The Environment: Tougher Posture",** *Chemical & Engineering News,* **v. 49, no. 7, 15 February 1971, p. 14.**

    Tough federal regulation is proposed to regulate the introduction of chemicals that may be hazardous to the environment. Brief recapitulations of President Nixon's proposals and Sen. Muskie's proposals are presented.

99. **"Nixon, Muskie Fight for the Mr. Clean Title",** *Engineering News Record,* **v. 186, no. 6, 11 February 1971, p. 11.**

    Presents key points in the two pollution bills before Congress – President Nixon's water pollution bill and Sen. Muskie's federal pollution control legislation. In spite of disagreement on the amount of money needed, "Muskie and Nixon agree on most other points".

100. **"Muskie Hints at Federal Pollution Takeover",** *Engineering News Record,* **v. 186, no. 7, 18 February 1971, p. 14.**

     Discusses Sen. Muskie's ideas of increasing the Federal Government's role in sewage-treatment-plant construction to aid regional efforts in pollution control.

101. **Broomfield, W. S., "Environmental Pollution",** *Congressional Record,* **v. 117, no. 7, 29 January 1971, p. E278.**

     Introduces two measures: one to provide for orderly regulation of dumping into the coastal waters, the other to provide for the creation of a standing Committee on Environment in the House of Representatives.

102. **Jackson, H. M., "Law, Lawyers, and the Environment",** *Congressional Record,* **v. 117, no. 12, 5 February 1971, pp. S930-S935.**

     Text of an address to the Course on Environmental Law, sponsored by The American Law Institute, the American Bar Association, and the Smithsonian Institution. Discusses the National Environmental Policy Act.

103. **Sax, J. L., "Introduction to Environmental Law",** *Congressional*

Record, **v. 117, no. 7, 29 January 1971, pp. S151-S556.**

Text of a paper presented at the Environmental Law Seminar.

FOREIGN AFFAIRS

104. *Science, Technology, and American Diplomacy: The Evolution of International Technology,* **prepared for the Subcommittee on National Security Policy and Scientific Developments of the Committee on Foreign Affairs, U.S. House of Representatives, by the Science Policy Research and Foreign Affairs Divisions, Legislative Reference Service, Library of Congress, December 1970, 70 pp. (Available from Committee on Foreign Affairs, Room 2170 Rayburn Building, Washington, D.C. 20515.)**

    First of some 16 reports to be issued on various facets of science-diplomacy interaction; discusses current and historical influences of technology on diplomacy; dwells on internationalization of technology and associated policy issues.

105. **"United States Open to Science Exchanges",** *Science,* **v. 171, no. 3970, 5 February 1971, p. 465. Also, "World Cooperation Needed",** *Chemical & Engineering News,* **v. 49, no. 5, 1 February 1971, pp. 7-8.**

    Reports Secretary of State Rogers statement to the House Committee on Science and Astronautics that the Administration is willing to exchange unclassified scientific information with any country "regardless of the state of our diplomatic relations with that country".

106. **"Negotiations Begun in 1966 Result in a First U.S.-Hungarian Academy Exchange Agreement",** *News Report,* **NAS/NRC/NAE, v. 20, no. 10, December 1970, p. 1.**

    Describes the bilateral agreement for exchange of visits totaling 40 man-months for U.S. scientists in Hungary and vice versa, to lecture, conduct seminars, exchange information, or engage in research in the physical and biological sciences, including mathematics, engineering sciences, and behavioral sciences; agreement expires 8/31/73.

107. **"Soviets Ask Bilateral Airworthiness Talks",** *Aviation Week & Space Technology,* **v. 94, no. 2, 11 January 1971, pp. 16-17.**

    Discusses considerations surrounding the USSR request to negotiate a bilateral airworthiness agreement with the U.S. to enable them to market Soviet aircraft to U.S. customers and obtain certification for such aircraft; describes the visit of a delegation to Russia from the Charlotte Aircraft Corp. to investigate and discuss the possibility of distributing the Soviet-built Yak-40 trijet short-haul airliner in the U.S.

108. **Packard, R. F., "Why International Cooperation in Space?",** *Astronautics & Aeronautics,* **v. 8, no. 12, December 1970, pp. 17,21.**

    Discusses the distinction between cooperation in space activities and cooperation **about** space activities, some disadvantages of cooperation, the advantages of cooperation; the author, Director of Outer Space Affairs of the U.S. State Dept., then concludes that the advantages far outweigh the disadvantages and that "cooperation in space should be seen as clearly a **necessity**".

109. **"U.S.-Soviet Agreement on Space Cooperation",** *Machine Design,* **v. 43, no. 1, 7 January 1971, p. 12.**

Reproduces the text of a formal agreement between NASA and the Academy of Sciences of the USSR, confirmed by an exchange of notes between G. M. Low for NASA and M. V. Keldysh for the Soviet Academy, setting forth procedures and a schedule for joint efforts to design compatible docking and rendezvous equipment.

110. **"Space Cooperation",** *Chemical & Engineering News,* **v. 49, no. 5, 1 February 1971, p. 21.**

Announces that the U.S. and the U.S.S.R. agreed at a January 18-21 Moscow conference on an immediate exchange of lunar surface samples; on procedures for working on improvement of weather-data exchanges, research with meteorological rockets, and techniques for studying the natural environment; and on expanded exchange of data on space biology and medicine.

111. **"U.S. and USSR Provide for High Energy Physics Exchanges at Serpukhov and Batavia, Illinois",** *AEC News Releases,* **v. 1, no. 24, 16 December 1970, p. 1.**

Announces the signing of a Protocol by representatives of the Soviet Union's State Committee for the Utilization of Atomic Energy and the U.S. AEC, providing a basis for joint experiments to be carried out at Serpukhov and Batavia; points out that, currently, 6 U.S. nuclear scientists are conducting research in the peaceful uses of atomic energy in USSR laboratories.

112. **Boffey, P. M., "Herbicides in Vietnam: AAAS Study Finds Widespread Devastation",** *Science,* **v. 171, no. 3966, 8 January 1971, pp. 43-46.**

Gives findings of an investigation by the AAAS Herbicide Assessment Commission on the effect of the military use of herbicides in Vietnam; includes details of the spraying program and the damage both to the land and people; also a rebuttal by Brig. Gen. Stone.

113. **McElheny, V. K., "Pugwash: Few Cheers for S.A.L.T.",** *Technology Review,* **v. 73, no. 2, December 1970, pp. 10-11.**

Describes Pugwash as "more than a gentlemen's club of scientists with furrowed brows" and presents an account of the positions and political bases of its individual members at the 1970 Pugwash conference last September in Wisconsin.

114. **Murphy, B., "Computing – the Future in Europe",** *New Scientist and Science Journal,* **v. 49, no. 739, 18 February 1971, pp. 358, 361.**

Reports that the U.S. recession has had two effects upon American computer companies in Europe: they have laid off staff in their European subsidiaries and have intensified their attack upon the European market; consequently, European companies are looking toward collaboration and more government participation.

FRANCE

115. **"France Creates Nature Ministry",** *Science,* **v. 171, no. 3972, 19 February 1971, p. 660.**

Announces the formation of a new French ministry for the "protection of nature and the environment", with a FY 1972 budget of $25 million and an initial assignment of implementing the 100 measures recommended by a High Committee on the Environment.

116. **"France: Boost to Nuclear Power",** *Chemical & Engineering News,* **v. 49, no. 11, 15 March 1971, p. 12.**

Announces France's intention to add 8000 Mw of nuclear power capacity to the 4650-Mw capacity of nuclear power plants operating and under construction now; discusses plant types, locations, and sources of enriched uranium.

117. **"Space Effort Declines",** *Nature,* **v. 228, no. 5276, 12 December 1970, pp. 1016-1017.**

A decrease of more than 20 percent in the budget of the Centre National d'Etudes Spatiales (the French Space Agency) is reported for last year; future plans of CNES and the French space program are discussed.

118. **Fink, D. E., "Applications Satellites, Launcher Work to be Stressed by CNES",** *Aviation Week & Space Technology,* **v. 49, no. 3, 18 January 1971, p. 16.**

Describes plans of the French national space agency (CNES) for spending its $146.3 million 1971 budget, including participation in the European Space Research Organization's (ESRO's) satellite programs, the European Launcher Development Organization (ELDO), national scientific programs, and bilateral programs with the U.S., Germany, and the USSR.

GERMANY

119. **Zierold, K.,** *Förschungsforderung in drei Epochen: Deutsche Forschungsgemeinschaft. Geschichte, Arbeitsweise, Kommentare,* **Franz Steiner Verlag, 1968, 638 pp. (DM70).**

Deals with the organization of the financial support of science in Germany, from the end of the First World War until the late sixties, based on documents, personal knowledge, statistics, and interviews with the surviving principals.

120. **"West Germany Becomes Pollution Conscious",** *Science Journal,* **v. 6, no. 12, December 1970, pp. 13-14.**

A start has been made in an antipollution program for West Germany with the publication of an official "Immediate Programme"; emphasis is mainly on increased support for research and not on practical measures.

121. **Stueck, H. J., "Urban Transit Model",** *Saturday Review,* **5 December 1970, pp. 62-63.**

Describes the Hamburger Verkehrsverbund (Verbund for short) which is a transportation system linking Hamburg, West Germany, with 233 surrounding communities, and which integrates all types of mass conveyances for the traveler's convenience.

GOVERNMENT-SCIENCE INTERACTION

122. *An Inventory of Congressional Concern with Research and Develop-*

ment, **91st Congress, 1969-70, Part 5, A Bibliography prepared for the Subcommittee on Executive Reorganization and Government Research of the U.S. Senate Committee on Government Operations, 2 January 1971, pp. 251-315. (Available U.S. Senate Committee on Government Operations, Washington, D.C. 20510.)**

Lists 760 public laws, reports, and documents showing Congressional concern with science and technology; contains a subject index under 19 major headings, cross referencing all publications included in the bibliography.

123. **Cohn, V., "Science in the Begabuck Era",** *Technology Review,* **v. 73, no. 4, February 1971, pp. 8-9.**

Discusses five basic guidelines of a science policy "shopping list" emerging from Washington's scientific leadership: guidelines show outline of better financial support to higher education and better utilization of scientific manpower.

124. **"Redirection of Effort",** *Chemical & Engineering News,* **v. 48, no. 51, 7 December 1970, p. 19.**

Current slowdown of research is seen as a redirection of effort: scientists and engineers are seen as partners of the government, thus the government is viewed as having an obligation to help ease the transition strain.

125. **Greenberg, D., "Is Nixon Beginning to See the High Importance of Science?",** *New Scientist and Science Journal,* **v. 49, no. 736, 28 January 1971, p. 194.**

Discusses the possibility that increases in science funding hinted at in the President's forthcoming budget papers may signal a new executive view of science.

126. **Hammond, A. L., "Federal R&D: Domestic Problems Get New Efforts But Little Money",** *Science,* **v. 171, no. 3972, 19 February 1971, pp. 657-661.**

Describes changes in Federal civilian agencies (DOT, HUD, Post Office, Justice) which are making them significant supporters and consumers of R&D; discusses their R&D capabilities, planned programs, and budgetary history and prospects.

127. **Handler, P., "The Federal Government and the Scientific Community", address delivered 26 December 1970 at AAAS meeting, Chicago, Ill.,** *Science,* **v. 171, no. 3967, 15 January 1971, pp. 144-151.**

Documents the commitments made by various U.S. Administrations to the support of education and research, and discusses the retreat from these goals during the past 4 years and the current condition of the scientific and academic communities.

128. **Boffey, P. M., "Federal Science: Differences of Opinion in the Highest Councils",** *Science,* **v. 170, no. 3965, 25 December 1970, pp. 1383-1384.**

Calls attention to the *New York Times* interpretation of National Academy of Sciences President Handler's press-conference remarks as criticizing the Nixon Administration for neglecting science and to the rebuttal by White House science adviser David.

129. **Vohra, H. R., "Ministry of Science – U.S. Style",** *Bulletin of the*

Atomic Scientists, **v. 27, no. 1, January 1971, pp. 29-32.**

Describes the history and structure of the White House Office of Science and Technology (OST) and the associated President's Science Advisory Committee (PSAC) and Federal Council for Science and Technology (FCST) – all headed by the Presidential Science Adviser; the supersonic transport is cited as an example in which the President rejected the advice of his "Science Czar" and backed it anyhow; the decision to denounce first use of chemical and biological weapons (CBW) is cited as an example of OST's success in toppling existing idols; also cited are the OST roles in space decisions and advice in international cooperation.

130. **"Report Assails Science Advisory Agencies",** *Chemical & Engineering News,* **v. 49, no. 1, 4 January 1971, pp. 22-23.**

Summarizes the conclusions of a 193-page report on "The Politics of Technology", based on a year-long study by 20 people in a Stanford Workshop, in which "excessive secrecy" now surrounding scientific advice to the Federal Government is assailed; calls for a redefinition of the role of the technical adviser, emphasizing his responsibility to the public at large.

131. **Greenberg, D., "The New Politics of Science",** *Technology Review,* **v. 73, no. 4, February 1971, pp. 41-45.**

Discusses the crisis of science, the need for a sense of true reality, socially responsible science versus neutrality, and the competition for the federal research dollar. The adversary process, as opposed to the closed-door policy of decision making is seen as good.

132. **Zuckerman, Sir S., "Technological Choice: The Social Cost",** *New Scientist,* **v. 48, no. 728, 3 December 1970, pp. 389-391.**

Discusses the tradeoffs between technology development and social cost of development; the importance of the role of politics in decisions affecting the long-term future is discussed, as is the need for the technologist to participate in decisions of politics.

133. **Levin, A. L., "Multisecting the Nation's Nondefense Programs",** *Public Administration Review,* **v. 31, no. 2, March/April 1971, pp. 170-179.**

"The design of a program structure to provide a framework within which all the purposes of the Department of Health, Education, and Welfare might be systematically ordered is described. The advantages of such a framework, as well as the problem of its design, are discussed . . . Finally, the actual and potential benefits of thinking about federal programs, in both defense and non-defense agencies, by means of such a framework are discussed."

134. *Government Patent Policy,* **Report of a Workshop, 29 September 1969, in Washington, D.C., conducted by the Subcommittee on Interaction with Industry, Committee on Interplay of Engineering with Biology and Medicine, National Academy of Engineering, 1970, 83 pp. (Available from NAE Committee on Interplay of Engineering with Biology, 2101 Constitution Ave., N.W., Washington, D.C. 20418.)**

Cites widespread concern in universities, industry, and government agencies over Federal patent policy, based on discussions by Workshop participants.

HOUSING AND BUILDING CONSTRUCTION

135. *Housing Research and Building Technology Activities of the Federal Government,* **Office of Science and Technology, Executive Office of the President, 1 June 1970, 117 pp. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: $1.25.)**

    Presents plans and programs of the Federal Government in building research and technology; broken down by agency (Agriculture, AEC, Commerce, DoD, OEO, GSA, HEW, HUD, Labor, Post Office, and VA; describes the coordinating and review mechanisms.

INDIA

136. **Barnaby, F., "India's Nuclear Views",** *New Scientist and Science Journal,* **v. 49, no. 737, 4 February 1971, pp. 268-269.**

    Questions whether India will soon acquire nuclear weapons; relates her aversion to the nonproliferation treaty and her fear that it will hamper development of peaceful nuclear energy; nuclear plans and capabilities of Japan and developing countries are discussed.

JAPAN

137. **"Japan's Pollution Grows with Population",** *Engineering News-Record,* **v. 185, no. 25, 17 December 1970, pp. 26-27.**

    Describes Japan's pollution problems caused by the rapid population growth coupled with a parallel boom in industrialization; outlines measures taken to control pollution, including legislation, government spending, and a system for compressing solid waste.

MANAGEMENT OF SCIENCE

138. **Handler, P.,** *Science and Scientists: Obligations and Opportunities,* **Sigma Xi Lecture, University of Houston, 21 October 1970. (Reprint available from Dr. E. J. Henley, President, Sigma Xi, Cullen College of Engineering, University of Houston, Houston, Texas 77004.)**

    Discusses events leading to the current plight of science; urges scientists and educators to voice their views on the role of science; discusses public issues and attitudes and their implications in both developed and developing countries; presents views on advanced education, research funding, and priorities.

139. **Ruina, J. P., "Can We Control the Goose That is Laying the Golden Eggs?",** *Innovation,* **no. 16, November 1970, pp. 36-41.**

    Proposes that humane technology will be developed if a healthy market can be provided for it; this would involve change in governmental and private institutional structures.

140. **Shils, E., "Of Pride and Men of Little Faith",** *Minerva,* **v. IX, no. 1, January 1971, pp. 1-6.**

    Reviews the era of high esteem and liberal funding for science and the universities and the benefits thereof; points out that the present antiscience wave is the result of neglect in certain areas by scientists, university teachers, and administrators; and cautions against forcing science and learning to deteriorate by joining in their denunciation.

141. **Himsworth, H.,** *The Development and Organisation of Scientific Knowledge,* **William Heinemann, London, 1970, 175 pp. (63s).**

Deals with concepts of the structure of scientific knowledge and suggestions for the organization of science at the national level – with emphasis on the U.K. situation.

142. **Boutry, G. A., "Quantity Versus Quality in Scientific Research (II): The Paper Explosion",** *Impact of Science on Society,* **v. XX, no. 3, July-September 1970, pp. 195-206.**

Discusses the three types of scientists: theoretical, applied, and fundamental, and points out that the quality versus quantity problem is greatest with the last type, whose research quality is affected adversely by "the sheer explosive increase in their numbers; the fact that increasingly a scientist's merits can only be judged by the volume, not the content, of his publications; and, in European laboratories, the slavish imitation of American work".

143. **"Establishment of a Department of Science and Technology in the Executive Branch",** *Congressional Record,* **v. 116, no. 205, 19 December 1970, pp. 20788-S20789.**

In a letter addressed to Sen. George D. Aiken, Adm. H. G. Rickover gives his opinion of the creation of a Department of Science and Technology to centralize all Federal research and development programs in a single Cabinet-level agency (S. 4453); gives reasons for not favoring the establishment of such an agency.

144. **Cordtz, D., "Bringing the Laboratory Down to Earth",** *Fortune,* **v. 83, no. 1, January 1971, pp. 106-108, 119-122.**

Discusses current attitudes by management toward R&D in industry, pointing out that the fraction of the research dollar going for basic research is decreasing, while at the same time the Federal Government is cutting back severely on its support for such work in the universities; expresses fear that business may be improving the present at the expense of the future, since applied efforts ultimately must build on the new knowledge generated by basic research.

145. **Gibbons, M., Metcalf, S., and Watkins, D., "Basic Research: A Nation's Burden or Benefit?",** *Science Journal,* **v. 6, no. 12, December 1970, pp. 71-74.**

Discusses industrial innovations and the theories on which they were based; the conclusion that science gives birth to technology is questioned and no justification is seen for government support of large basic research programs.

146. **Anderson, A. G., "Let's Put New Life Into R&D",** *Center Report, A Center Occasional Paper,* **v. IV, no. 1, February 1971, p. 22.**

IBM Vice-President Anderson makes specific recommendations for organization policies designed to maintain the intellectual vitality of professionals in R&D in the face of fading financial support and increasing unemployment of skilled scientists and engineers.

147. **Kassem, M. S., and Wagner, W. B., "Scientists Who Migrate in Teams – And How to Manage Them",** *Technology Review,* **v. 73, no. 2,**

December 1970, pp. 29-33.

Suggests that instead of considering its scientists as isolated individuals, to be dealt with one at a time, progressive management must regard them as members of integrated work teams; cites examples of hirings of whole groups of scientists from one corporation by another; presents reasons why scientists team and why employers want teams, as well as implications of team hiring.

148. **"Academy Critic Shoots Wildly but Hits Sore Spot",** *Nature,* **v. 229, no. 5281, 15 January 1971, pp. 151-152.**

Reports on criticisms of the National Academy of Sciences by former Secretary of the Interior S. L. Udall at the AAAS meeting, where he accused the Academy of failure to alert the public to the dangers of technological advance, of providing "a convenient rationale" for "the SST lobby, highway contractors, [and] the Defense Department", and of being afraid to speak out for fear of offending its sole customer, the Government; rebuttals by Academy spokesmen are included.

MANPOWER, TECHNICAL AND SCIENTIFIC

149. **"Manpower Needs Predicted Through '80's",** *Chemical & Engineering News,* **v. 49, no. 1, 4 January 1971, pp. 9-10.**

Presents some policies suggested by Dr. A. M. Cartter of New York University for minimizing the impact of the poor employment situation for scientists and engineers, particularly Ph.D.'s, expected in the '70's and 80's; also gives (contradictory) predictions by the Department of Labor's Bureau of Labor Statistics that the number of chemists, physicists, physicians, and engineers available in 1980 will be below needs, while life scientists, mathematicians, and teachers will be in excess of needs.

150. **"Programs Try to Halt Growing Unemployment",** *Chemical & Engineering News,* **v. 49, no. 11, 15 March 1971, pp. 28-29.**

Discusses efforts of Federal and local governments to retrain and relocate the growing number of jobless scientists and engineers; includes comments by members of the Engineering Manpower Commission of the Engineers Joint Council to the effect that these efforts have been rather minimal and short sighted.

151. **"Jobless Scientists Aided",** *Chemical and Engineering News,* **v. 49, no. 10, 8 March 1971, pp. 9-10.**

Reports on two meetings aimed at tackling employment problems of scientists and engineers; the first was a working conference in Washington chaired by Science Adviser David; at the second, in Massachusetts, congressmen led by Rep. Morse embarked on a campaign to bring the full resources of the Federal Government into a coordinated effort to provide jobs; statistics for unemployment are discussed.

152. **"Economic Recovery May Not Revive Technical Job Market",** *Industry Week,* **v. 168, no. 8, 22 February 1971, pp. 11-13.**

Presents various views, predictions, and suggestions regarding unemployment of scientists and engineers, including the concept that the employment market would have sagged even without Federal spending cutbacks, because of overproduction of scientific manpower.

153. *Science & Government Report,* **v. 1, no. 4, 15 March 1971, 4 pp.**
Lead article discusses current unemployment of engineers and scientists, the inadequacy of Government action to help, and possible consequences.

154. **"Administration Officials Use Unemployment as 'Transient' ",** *Washington Science Trends,* **v. 25, no. 20, 22 February 1971, p. 115.**
Discusses Administration attitudes on the plight of scientists and engineers caught in defense, aviation, and space cutbacks, and the few remedies that have been proposed or are being tried.

155. *Prospects of Engineering and Technology Graduates, 1970,* **Engineers Joint Council, October 1970, 40 pp. (Available from Engineering Manpower Commission, Engineers Joint Council, 345 E. 47 St., New York, N.Y. 10017. Price: $2.00.)**
Presents results of seventh annual survey of trends in placement and occupation of new engineering graduates, broken down by degree and field; shows percentages employed, entering military, returning to full-time study, considering job offers, and without offers; shows average monthly starting salaries for workers with various degrees; contains 21 tables and 5 figures.

156. **Clark, H. C., "Universities and the Job Shortage for Scientists",** *Science Forum 18,* **v. 3, no. 6, December 1970, p. 2.**
Discusses the disillusionment of graduate students with the employment situation and recommends that the universities alter the emphasis in scientific education and base admission only on high academic requirements.

157. **"Environment Engineers Can't Sell Their Expertise",** *Machine Design,* **v. 43, no. 2, 21 January 1971, p. 12.**
Reports the testimony of T. B. Robinson, president of the Consulting Engineers Council, that experienced pollution-abatement consulting firms are now working at only 50 to 60 percent of their capacity.

158. **"Laissez-Faire on the Breadline",** *Nature,* **v. 230, no. 5289, 12 March 1971, pp. 77-78.**
Discusses the Administration's impassive attitude toward jobless scientists and describes the Kennedy bill and the Davis-Giamo bill – both designed to improve the employment picture among scientists and engineers by retraining them and converting defense and aerospace industries to more needed endeavors.

159. **Winston, D. C., "Bills Introduced to Reorient Research to Social Goals",** *Aviation Week & Space Technology,* **v. 94, no. 8, 22 February 1971, p. 21.**
Describes the background and main features of House and Senate bills introduced to facilitate the conversion from a weapons-oriented technology to one dealing with civilian problems and thus provide work for small aerospace companies and for skilled technical personnel displaced by cutbacks in defense and space research spending.

160. **Simon, S., "From Aerospace to the Environment",** *Innovation,* **no. 17, January 1971, pp. 2-11.**

Discusses the difficulties involved in switching aerospace engineering talent to the environmental field, and concludes that retraining would make the venture prohibitively expensive. Offers suggestions to aerospace management about economic and political aspects of pollution.

161. **"Testimony by Hon. Bob Casey, on Utilization of Capabilities of NASA and Aerospace Industry in the Environmental Field",** *Congressional Record,* **v. 116, no. 191, 1 December 1970, pp. H10959-H10961.**

Presents a transcript of the statement before the Government Operations Subcommittee on Conservation of Natural Resources, outlining many of the earth's environmental problems and calling attention to developments by the aerospace industry that are applicable to their solution.

162. **Walsh, J., "Aerospace: Unemployed Scientists, Engineers Have No Place to Go",** *Science,* **v. 170, no. 3965, 25 December 1970, pp. 1384-1387.**

Describes the plight of Santa Clara County, California, with its high fraction of unemployed professionals, and the not-too-promising attempts to do something about it at both state and national levels (moratoriums on credit payments, altered pension policies, conversion and retraining programs).

163. **"Labor Says Whoa to Engineers",** *Science,* **v. 171, no. 3972, 19 February 1971, p. 660.**

Announces that all fields of engineering have been dropped from the Department of Labor's list of occupations for which preference is given in immigration.

164. *Scientific and Technical Personnel in Industry, 1967,* **Bulletin 1674, U.S. Department of Labor, Bureau of Labor Statistics, 1970, 58 pp. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: 60 cents.)**

Present findings of a survey of the 1967 industrial employment of scientists and engineers (omits employees of government, nonprofit organizations, and educational institutions), measuring levels and trends of employment for each of 17 occupations in 82 different industries as a base for projections, career counseling, manpower planning, and ascertaining training needs.

165. *Scientific, Technical, and Health Personnel in the Federal Government, 1969,* **Surveys of Science Resources Series, National Science Foundation, Report NSF 70-44, November 1970, 40 pp. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: 50 cents.)**

Presents trends in employment 1959-1969; for 1969, gives distribution by occupation, work activity, agency, geographic location, and salary; text has 3 charts and 8 tables; includes 2 appendixes.

MULTINATIONAL SCIENCE ACTIVITIES

166. **David, E. E., Jr., Views on the Need for International Science Policy and Concepts for International Scientific Cooperation,** *Congressional Record,* **v. 117, no. 8, 1 February 1971, pp. E320-E322.**

Text of address to the Advisory Panel on Science and Technology of the House Committee on Science and Astronautics at a 3-day session on International Science Policy; discusses how nations can cooperate to maximize the use and development of worldwide R&D resources while still protecting national economic and proprietary interests.

167. **"Panels Air International Science Policy",** *Chemical & Engineering News,* **v. 49, no. 6, 8 February 1971, pp. 39-43.**

Reports highlights of discussions at a 3-day meeting of the House Committee on Science and Astronautics with its panel on science and technology and invited guests (former Congressman Daddario; Dr. V. Ambartsumian, president of the International Council of Scientific Unions; Dr. H. Brown, foreign secretary of the National Academy of Sciences; Dr. T. Odhiambo, director of the International Center of Insect Physiology and Ecology; Dr. A. Spilhaus, Woodrow Wilson International Center for Scholars; and others); airs views on the kinds of international organizations needed to formulate and implement an international science policy, with emphasis on developing nations.

168. **Greenwood, J. W., "The Scientist-Diplomat: A New Hybrid Role in Foreign Affairs",** *Science Forum,* **v. 4, no. 1, February 1971, pp. 14-18.**

Discusses the role of scientific specialists on embassy staffs in foreign countries to perform scientific or technological liaison, trade promotion, monitor foreign aid, or provide science diplomacy.

169. **Haskins, C. P., "Science and Policy for a New Decade",** *Foreign Affairs,* **v. 49, no. 2, January 1971, pp. 237-270.**

Broad-ranging discussion of the challenges of scientific and technological relations among the developed nations of the world; international collaboration during the coming decade; technology education problems of the developing nations; and federal funding of science.

170. **"Technology Flow Corrodes Iron Curtain",** *New Scientist and Science Journal,* **v. 49, no. 735, 21 January 1971, p. 118.**

Reports on the inaugural meeting of the new permanent British-USSR commission, at which numerous earlier contacts and agreements for scientific and technological cooperation between the two countries were consolidated; enumerates areas of ongoing or planned joint efforts.

171. **Thompson, H., "European Exchange to Promote Science",** *New Scientist and Science Journal,* **v. 49, no. 739, 18 February 1971, pp. 354-356.**

Discusses international cooperation between scientists and points out that the simplest and perhaps cheapest form of international scientific cooperation is the interchange of research workers themselves between laboratories; describes the Royal Society's European exchange program, begun in 1967, its success, and how it should be developed further.

172. **Benn, A. W., "Science, Europe, and a New World",** *New Scientist and Science Journal,* **v. 49, no. 739, 18 February 1971, pp. 348-350.**

Attempts at technological unity of Europe in the past have led to disenchantment; since the establishment of Minitech, devoting itself mainly to industrial policy, the emphasis of European technological cooperation has become more practical; new foundations are being laid which will alter the relations between the nation states, with the U.S., and the Iron Curtain countries.

173. **Barnaby, F., "Euratom – the Sick Leading the Six?",** *New Scientist and Science Journal,* **v. 49, no. 739, 18 February 1971, pp. 356-357.**

Industrial nationalism has jeopardized Euratom and made impossible the technological cooperation needed to enable western Europe to compete in advanced technology markets; to narrow the technology gap between Europe and the U.S. and to rejuvenate Euratom, the establishment of two new research organizations has been proposed by the Common Market Commission.

174. **Todd, W. M., and Voss, J., "The Consortium of Academies: A New Way to Found International Scholarly Institutions",** *Bulletin of the Atomic Scientists,* **v. 27, no. 2, February 1971, pp. 29-32.**

Discusses cooperative efforts among academies of science and scientific societies as a potentially useful device for international cooperation in the scientific community; describes three new international institutions being established by a small number of active academies: (1) The International Center for the Study of Insect Physiology and Ecology (ICIPE), (2) The International Science Foundation, and (3) The Center for the Study of Problems of Advanced Societies; delves into the qualities of academies that make them suitable foci for such organizations.

175. **"East-West Research Center; U.S., Soviets to Meet",** *Science & Government Report,* **no. 6, 15 February 1971, p. 6.**

Describes background and planned discussions among the deputy chairman of the State Committee for Science and Technology of the U.S.S.R., the president of the U.S. National Academy of Sciences, and representatives of England, West Germany, France, and Italy regarding the establishment of an international large-scale policy research institute.

176. **"OECD Tasks, Tools, Trends",** *The OECD Observer,* **no. 49, December 1970, pp. 19-24.**

Lists main goals of the Organisation for Economic Cooperation and Development, member countries, organizational structure, and describes activities in the areas of economics and statistics, environment, development, international trade, financial affairs, science and education, agriculture and fisheries, manpower and social affairs, industry and energy, and nuclear energy.

177. **Ellis, W. N., "The Crisis in Science and UNESCO",** *Bulletin of the Atomic Scientists,* **v. 27, no. 2, February 1971, pp. 33-35.**

Presents a searching analysis of the United Nations system and the role of UNESCO (United Nations Educational, Scientific, and Cultural Organization) in international considerations of the priorities of science as needed by man; discusses why UNESCO has not been looked to for service and leadership in man's "struggle for survival", and offers recommendations for bringing UNESCO more into line with world needs in spite of political barriers inherent in its 127 member-state constituency.

178. **Brabyn, H., "UNISIST for World Science",** *New Scientist and Science Journal,* **v. 49, no. 742, 11 March 1971, pp. 568-569.**
Announces publication by UNESCO and the International Council of Scientific Unions (ICSU) of plans for a world science information service (see *Science Policy Bulletin,* v. 3, no. 2, Abstract 8040), to be put before an international conference in Paris in October; briefly discusses system design, language problems, and organization. ("Report on the Feasibility of a World Science Information System" is available for $4.00 from Department of Publications, Unesco, Place Fontenoy, Paris 7, France.)

179. **"International Abstracting System Planned",** *Chemical & Engineering News,* **v. 48, no. 53, 21 December 1970, p. 47.**
Announces that the International Council of Scientific Unions Abstracting Board, including representatives of 11 of the world's major abstracting and indexing services from France, Germany, the U.S., the U.S.S.R., and the U.K., has agreed to go ahead with a plan for the first stage of a system for abstracting and indexing services for science and technology; briefly describes the plan.

180. **Chedd, G., "A New Lab for Europe?",** *New Scientist and Science Journal,* **v. 49, no. 739, 18 February 1971, pp. 350-352.**
Outlines developments in establishment of the proposed European Molecular Biology Organization laboratory; discusses opposition to the laboratory, changes in the concept of the laboratory, and the recent formation of the European Molecular Biology Conference; states that prospects for the lab look good, if the member governments resist the temptation to play politics over the site.

181. **Heumann, G., "Panavia 200 Gets Ready to Fly",** *Machine Design,* **v. 43, no. 5, 18 February, 1971, pp. 30-31.**
Outlines the status and problems of the joint German-U.K.-Italian MRCA (multirole combat aircraft) program; describes the projected roles of each country in production of the hypersonic Panavia 200; and predicts future cooperative European military aircraft projects with the U.S. shut out.

182. **Valery, N., "300 GeV Machine: Object Lesson in Scientific Autism",** *Science Journal,* **v. 7, no. 1, January 1971, pp. 3-4.**
Presents a detailed account of the vicissitudes of the European cooperative project to build a 300 GeV accelerator at CERN, Geneva, which received a substantial boost when the U.K. decided to rejoin the program (Ref. 402).

183. **Vichney, N., "What Future for Advanced Reactors in Europe?",** *New Scientist,* **v. 48, no. 729, 10 December 1970, pp. 434-435.**
Outlines the various organizations and activities of the British, Germans, French, and Americans individually in the development of high-temperature gas-cooled nuclear power reactors, and speculates on the possibility of a "tripartite European club", based on negotiations among French, German, and British industrial groups, for the design and construction of future nuclear power stations.

184. *Manual for Surveying National Scientific and Technological Potential,*

Science Policy Studies and Documents, no. 15, UNESCO, 1970, 251 pp. (Available from the UNESCO Publications Center, P.O. Box 433, New York, N.Y. 10016. Price: $3.50.)

Presents guidelines for surveying, analyzing, and reporting a country's scientific and technological potential; in three parts: data collection, processing, and exploitation to formulate a true national science policy; contains six annexes giving model questionnaires, standard classifications of educational and industrial activities, and a bibliography.

NORTH VIETNAM

185. **Rose, S., and Rose, H., "Science in North Vietnam",** ***New Scientist and Science Journal,*** **v. 49, no. 735, 21 January 1971, p. 134-136.**

Reports the aims of science in North Vietnam, a nation under air attack; a huge educational program has abolished illiteracy; a vaccination program has brought diseases under control; escalation in types of weaponry and effects of defoliants are discussed.

OCEAN – INTERNATIONAL ACTIVITIES

186. **"Towards a Law of the Sea",** ***New Scientist,*** **v. 48, no. 731, 24 December 1970, p. 536.**

Discusses attempts in the U.N. General Assembly to establish a new Law of the Sea Conference and how the conference will be prepared; states that the continental slope will figure prominently in the debate; mentions the International Decade of Ocean Exploration.

187. **"Seabed and the Law of the Sea – Tribute to Senator Pell",** ***Congressional Record,*** **v. 116, no. 206, 21 December 1970, pp. S20998-S20999.**

Quotes a statement of Senator Claiborne Pell, as a U.S. representative to the United Nations, made on November 26 to Committee I, the topic being the need for international cooperation and for a Law of the Sea Conference; also includes the declaration of principles governing the sea-bed passed by the General Assembly.

188. **"Britain's House of Lords Debates Center's Draft Model for Ocean Regime",** ***Center Report, A Center Occasional Paper,*** **v. IV, no. 1, February 1971, pp. 8-12.**

Quotes arguments of Lord Ritchie-Calder [illegible] a motion "that the seabed, beyond the limits of national jurisdiction, should be administered as a common heritage of mankind and a world ocean regime created to that end through an international convention". Cites expected problems related to exploitation of seabed mineral resources.

189. **"Exploitation Rights",** ***Nature,*** **v. 228, no. 5278, 26 December 1970, pp. 1248-1249.**

Reports that a symposium on the exploration and exploitation of the seabed and its subsoil, organized by the Council of Europe, was a first step toward a possible unified European effort to exploit the wealth of the oceans; states that recommendations for the establishment of a European Ocean Space Commission and an Institute for Ocean Studies could be made.

190. **Tobin, R. L., "Access to the Oceans' Wealth",** *Saturday Review,* **28 November 1970, p. 24.**
Considers the 1970-71 U.N. General Assembly as the proper place to begin to settle the problems having to do with equitable access to the wealth of the world's oceans; discusses an article in "Ceres", an FAO publication, which depicts the complexity of the non-military problems and states that the FAO insists on international solutions.

191. **Pell, C., "Seabed Resources",** *Congressional Record,* **v. 116, no. 205, 19 December 1970, pp. S20787-S20788.**
Discusses his attendance as a delegate to the 25th session of the U.N. General Assembly which internationalized the seabed and ocean floor; resolutions, which consist of a declaration of legal principles and a timetable for a general Law of the Sea Conference in 1973, are printed here.

192. **Purrett, L., "The Politics of Marine Research",** *Science News,* **v. 99, no. 1, 2 January 1971, pp. 9-11.**
Points out that restrictions by various nations on access to territorial waters are seriously jeopardizing ocean research; cites examples; discusses actions that might be taken to solve the problem.

OCEAN – POLLUTION

193. **Schachter, O., and Serwer, D., "Marine Pollution Problems and Remedies",** *American Journal of International Law,* **v. 65, no. 1, January 1971, pp. 84-111. (Reprint available from United Nations Institute for Training and Research, 801 United Nations Plaza, New York, N.Y. 10017.)**
Presents pertinent facts about the marine environment; treats what appear to be the most important marine pollution problems, summarizing where the pollutants originate, their prevalence in the marine environment, their effects on the environment, what international controls now apply, and prospects for future pollution and its control.

194. *Wastes Management Concepts for the Coastal Zone, Requirements for Research and Investigation,* **Committee on Oceanography, National Academy of Sciences and Committee on Ocean Engineering, National Academy of Engineering, 1970, 126 pp. (Available from Printing and Publishing Office, National Academy of Sciences, 2101 Constitution Ave., N.W., Washington, D.C. 20418. Price: $3.50.)**
Discusses man-caused pollution of continental-shelf waters and other ocean regions, the critical need for guidelines for designing waste-treatment and disposal systems, the need for good water-quality-monitoring instruments, and the lack of knowledge about the effects of wastes on chemical and biochemical processes.

195. **McTaggart-Cowan, P. D., "Oil Tankers and Pollution of the Oceans:**

Stupidity is No Excuse", *Science Forum 18,* **v. 3, no. 6, December 1970, pp. 10-14.**

Calls attention to the very high probability of oil spills in the ocean and the lack of laws and enforcement to prevent them; recommends ways in which Canada can equip itself to cope with spills, including a sizable R&D effort covering 23 specific areas.

196. **Peter, W. G. III, "CEQ Report on Ocean Dumping",** *BioScience,* **v. 20, no. 23, 1 December 1970, pp. 1270-1271.**

Reviews findings and recommendations, research recommendations, and alternatives to ocean dumping as reported in the Council on Environmental Quality's report, "Ocean Dumping – A National Policy".

197. **"Ocean Dumping Report Urges Immediate Action",** *Oceanology International,* **v. 5, no. 12, December 1970, p. 11.**

Discusses briefly the Environmental Quality Council's report on ocean dumping and its recommendations; indicates that the Nixon Administration will propose legislation to carry out the recommendations.

198. **"Ocean Dumping Poses Growing Problem",** *Chemical and Engineering News,* **v. 48, no. 50, 30 November 1970, pp. 40-41.**

Report of a study by Dr. D. D. Smith and R. P. Brown of the Dillingham Environmental Co., La Jolla, Calif., for the Bureau of Solid Waste Management; includes statistical information from a survey of ocean dumping; discusses types of wastes dumped at sea and disposal areas; concludes that environmental consequences are still largely unknown, major research is needed, and present regulation is completely inadequate.

199. **"Ocean Dumping",** *Congressional Record,* **v. 116, no. 206, 21 December 1970, pp. S21015-S21016.**

Includes a report by Walter Cronkite, reporting for CBS Radio, on the implications of the discovery of mercury in deep sea tuna and on the efforts of Senator Nelson to get this country to adopt a tough new national policy to protect the ocean environment.

200. **Nelson, G., "Stop Killing Our Oceans",** *Congressional Record,* **v. 117, no. 13, 8 February 1971, pp. S996-S997.**

An article, originally printed in *Reader's Digest,* February 1971, describes the dangers from the accelerated pollution of the sea; Senator Nelson has introduced an ocean-dumping-control bill and an oil-well-drilling-moratorium bill.

201. **"Fascell Introduces Legislation to Control Ocean Dumping",** *Congressional Record,* **v. 117, no. 16, 11 February 1971, p. E670.**

Bills introduced call for an international agreement to prohibit dumping in the waters of the world, give the EPA final authority for approval of plans to dispose of military or waste material in international waters, and require the DOD to review all hazardous munitions and chemicals to determine date and means of disposal.

202. **Boyle, R. H., "Poison Roams Our Coastal Seas",** *Congressional Record,* **v. 117, no. 19, 19 February 1971, pp. E943-E946.**

An article in the October 1970 issue of Sports Illustrated magazine describes a study conducted by WARF Institute, which showed that the flesh of fish from many locations contains more mercury than allowed by the FDA in fish for human consumption; a table lists fish species, location taken, residue data, and analytical methods employed.

OCEAN – U.S. ACTIVITIES

203. **Spangler, M. B.,** *New Technology and Marine Resource Development,* **A Study in Government-Business Cooperation, Praeger Special Studies in U.S. Economic and Social Development, published in cooperation with the National Planning Association by Praeger Publishers, New York, 1970, 607 pp. ($20.00.)**

    Presents results of a study of the economic, social, and political aspects of the application of science and technology to the utilization of marine resources; in six parts: planning marine resource development, successful marine mineral ventures, marine mineral ventures of high risk, new technology and the use of living marine resources, uses of the coastal zone, and Federal measures for encouraging private-enterprise investments in marine-resource development; contains 21 chapters, 2 appendixes, 29 tables, and 8 figures.

204. *Oceanography '69,* **Annual Report of the Commander, U.S. Naval Oceanographic Office, Washington, D.C., Fiscal Year 1969, 70 pp. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: 50 cents.)**

    Summary of activities of the U.S. Naval Oceanographic Office (NAVOCEANO) including data collection, evaluation, and production; R&D; management, training, and administration; navigational information dissemination; and forecasting – all directed toward enhancing the combat readiness of the U.S. Navy.

205. **"Ocean Briefing Planned",** *Washington Science Trends,* **v. 25, no. 23, 15 March 1971, p. 134.**

    On June 2, Government officials will speak on Federal oceanographic and coastal programs, Environmental Policy Act of 1969, Army and Navy ocean activities, and NOAA's programs. For details, contact National Oceanography Association, 1900 L St., N.W., Suite 301, Washington, D.C. 20036.

206. **LaMotte, C., "NOAA Shapes Up",** *Ocean Industry,* **v. 5, no. 12, December 1970, p. 19.**

    Discusses NOAA organization and budget, ocean-related legislation, a proposed ban on ocean dumping, and Nixon's authorization for construction of 300 merchant ships over the next 10 years.

207. **"1970 – A Vintage Year on the Hill",** *Oceanology International,* **v. 6, no. 1, January 1971, p. 14.**

    Reports that the last 12 months stand out as a period of legislative and administrative accomplishment in marine affairs; lists Congressional achievements in three major areas: environmental quality, orderly development of ocean resources, and resurrection of the moribund Merchant Marine.

208. **McLean, W. B., "A Technical Director's View of National Oceanic**

Interests", *Congressional Record*, v. 116, no. 187, 23 November 1970, pp. E9792-E9793.

A speech given by the technical director of the Naval Undersea Research and Development Center at a meeting of the American Oceanic Organization; opinions are expressed on the military capabilities of missiles, the future needs for transportation in the oceans, political obstacles to technical objectives, and the need for experiments on environmental modeling.

PANAMA CANAL

209. **"Sea-Level Canal: How the Academy's Voice was Muted", *Science*, v. 171, no. 3969, 29 January 1971, pp. 355-356.**

Discusses points of disagreement in studies made by a National Academy of Sciences committee, the special presidential Canal Study Commission, and Battelle Memorial Institute; the studies assessed the ecological implications of a sea-level canal through Panama; the Atlantic-Pacific Interoceanic Canal Study Commission recommended that the canal be built.

PERSONALITIES

210. **Lepkowski, W., "The New U.S. Science Adviser and the Problems He Faces", *Science Forum 18*, v. 3, no. 6, December 1970, pp. 25-26.**

Discusses background and character of Edward David, Jr., Nixon's science adviser; reviews his predecessor's problems and qualities; and talks about the challenges he faces.

211. **"Friend of Science?", *Nature*, v. 230, no. 5288, 5 March 1971, pp 9-10.**

Gives biographical sketch and discusses qualifications of Edward P. Boland, who has recently become chairman of the subcommittee on Independent Offices and Housing and Urban Development which decides the budgets of NASA and the NSF.

212. **"A Leader Found", *Nature*, v. 230, no. 5288, 5 March 1971, p. 10.**

Reports appointment of Dr. James C. Fletcher, president of the University of Utah, as the new head of NASA; discusses other people considered for the job.

213. **Walsh, J., "Commerce Department: Myron Tribus, Top Science Official, Resigns", *Science*, v. 170, no. 3962, 4 December 1970, pp. 1065-1066.**

Discusses the history of the post of assistant secretary for science and technology in the Commerce Department and the reasons behind Tribus' resignation from that post, including the role of the newly formed agencies EPA and NOAA.

214. **"New Environment Chief May Cause a Ruckus", *Engineering News Record*, v. 185, no. 26, 24 December 1970, p. 10.**

New head of the EPA expects to make people angry in carrying out his duties. His strongest weapon in the cleanup campaign will be court suits under the provisions of the Refuse Act of 1899.

215. **Agnello, L. A., "House Science Subcommittee: More Than a Face Change",** *Chemical & Engineering News,* **v. 49, no. 11, 15 March 1971, p. 29.**

Summarizes an interview with Rep. J. W. Davis, chairman of the House Subcommittee on Science, Research, and Development, in which Davis announced his intention to see that the talents on his subcommittee are fully utilized and recognized and that, while considering himself science's advocate, he intends to examine critically all proposals presented to the subcommittee by the scientific community.

216. **"Science Advisers",** *Science,* **v. 171, no. 3970, 5 February 1971, p. 465.**

Announces Nixon's appointment of 5 new members to the President's Science Advisory Committee (PSAC): L.A. DuBridge, past head of OST; H. Friedman, chief scientist of E. O. Hulbert Space Research Center at the Naval Research Laboratory; D. P. Moynihan, Harvard Graduate School of Education; K. H. Olsen, president of Digital Equipment Corp.; and J. G. Truxal, vice-president of Brooklyn Polytechnic Institute.

PHILIPPINES

217. **Cortes, J. R., "Factors Associated with the Migration of High-Level Persons from the Philippines to the U.S.A.",** *Science Review,* **v. XI, no. 1, January-February 1970, pp. 3-17.**

Identifies major factors associated with the migration of high-level persons from the Philippines to the U.S.; discusses ways to predict migration and to reduce the outflow; a résumé of the author's dissertation; includes 12 tables and a bibliography.

218. **Moravcsik, M. J., "On Brain Drain in the Philippines",** *Bulletin of the Atomic Scientists,* **v. 27, no. 2, February 1971, p. 36.**

Disagrees with A. Muriel's study of brain drain in the Philippines *(Science Policy Bulletin,* v. 3, no. 5, Abstract 9019); gives reasons why "pure" science is essential in a developing country and should be encouraged.

POLICY MAKING BODIES

219. **"Will NAE Make Its Move?",** *Astronautics & Aeronautics,* **v. 9, no. 2, February 1971, pp. 13-15.**

Discusses the history, membership, purposes, and activities of the National Academy of Engineering as "official advisor to the government".

220. *Federal Council for Science and Technology, 1969 Annual Report,* **Office of Science and Technology, Executive Office of the President, 29 pp. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: 25 cents.)**

Gives Council membership and appended listing of members of active FCST committees and their 1969 published reports; text presents highlights of 1969 activities of the Council and each of its committees.

221. **"Institute of Medicine",** *Science News,* **v. 99, no. 1, 2 January 1971, p. 8.**

Announces the activation of a new Institute of Medicine of the National Academy of Sciences, with Dr. R. J. Glaser as acting president, to be concerned with health-care problems in the U.S.

222. **Lindsay, S., "Backing the Good Guys",** *Saturday Review,* **5 December 1970, p. 64.**

Discusses the activities of the newly formed League of Conservation Voters, a "nonpartisan group dedicated to the election of candidates with good records on ecological questions and defeat of those with poor records".

POLLUTION – AIR

223. **"Atmospheric Monitoring: Prototype for Global Network",** *Science News,* **v. 99, no. 2, 9 January 1971, p. 24.**

Mentions need for global monitoring system to measure man-made and natural environmental changes and cites work on a prototype reconnaissance station at the National Center for Atmospheric Research in Colorado.

224. **Cole, E. N., "Remarks by Edward N. Cole, President, General Motors Corp.",** *Congressional Record,* **v. 116, no. 184, 18 November 1970, pp. E9715-E9718.**

Discusses efforts being made in the automobile industry to minimize pollution, criticizes federal legislation on auto pollution as "creating serious problems for our industry"; discusses various aspects of pollution standards as they apply to automobile pollution.

225. *Guide to Research in Air Pollution, 1969,* **Pennsylvania State University, Report PB 192220, 1971, 198 pp. (Available from National Technical Information Service, Springfield, Va. 22151. Price: $3.00.)**

Presents results of a survey listing 1381 air-pollution-research projects active in Calendar 1969, arranged by state or country, by category, and by principal investigator.

226. **Swihart, J. M., "The U.S. SST and Air Quality", Paper presented at Society of Automotive Engineers Conference on Aircraft and the Environment, Washington, D.C., 8-10 February 1971, Reprint 710320, 10 pp.**

Describes qualitatively Boeing's studies relating to the potential of the supersonic aircraft for polluting the air and for altering the world's climate and weather; concludes that such fears are not justified by the evidence, but points out that in some cases more data are needed for positive conclusions.

POLLUTION – INTERNATIONAL COOPERATION

227. **Wilson, T. W., Jr., "The Environment: Do the Polluted Clouds Have a Silver Lining?",** *The Futurist,* **v. 5, no. 1, February 1971, pp. 26-29.**

Keeping man from choking in the wastes of "progress" will require universal social change so vast as to be a cultural mutation; the struggle, if won, could be a way toward peace and harmony among the nations of the world.

228. **"Pollution Costs: Multination Poser",** *Chemical and Engineering News,* **v. 49, no. 4, 25 January 1971, p. 9.**
Covers an international pollution meeting sponsored by the Atlantic Council of the U.S. and Battelle Memorial Institute; the conference focused on the international economic consequences of national proposals to curb pollution.

POLLUTION – MERCURY

229. **"Meddlesome Mercury",** *Science News,* **v. 99, no. 1, 2 January 1971, p. 7.**
Discusses mercury in the environment, the state of knowledge about its toxicity, and what controls are being used.

POLLUTION – NOISE

230. **"Report of Citizens Panel on Noise Abatement Issued by Department of Commerce",** *U.S. Department of Commerce News,* **Office of the Secretary, Washington, D.C. 20230, 21 March 1971, 3 pp.**
Announces publication of the Department of Commerce final report of its Panel on Noise Abatement, which concludes that noise pollution in the U.S. is on the verge of reaching a serious level and recommends 12 steps to reverse the trend. (A summary report of the panel's study "The Noise Around Us: Findings and Recommendations", is available from the U.S. Government Printing Office, Washington, D.C. 20402. Price: 50 cents. The complete report, COM-71-00147, is available from the National Technical Information Service, Springfield, Va. 22151. Price: $6.00.)

231. **"S. 4538 – Introduction of the Noise Abatement Act of 1970",** *Congressional Record,* **v. 116, no. 188, 24 November 1970, pp. S18795-S18799.**
Senator Hatfield introduced legislation to create an Office of Noise Abatement within the Environmental Protection Agency; noise pollution is discussed; purpose of the bill and functions of the Office are outlined.

232. **Baron, R. A., "Let Quiet be Public Policy",** *Saturday Review,* **7 November 1970, pp. 66-67.**
Lists goals of noise abatement and recommends steps which should be taken to eliminate this form of environmental pollution; a preview of the author's book, *The Tyranny of Noise,* published by St. Martin's Press.

233. **Collier, H. R., "Noise Legislation is Necessary",** *Congressional Record,* **v. 117, no. 24, 26 February 1971, p. E1234.**
The problem of the effects of increasing noise levels in our environment is considered; an editorial entitled "Noise Legislation is Necessary" is reprinted from the Los Angeles Times; it summarizes the problem and points to a solution.

234. **"Costing Urban Quiet",** *Technology Review,* **v. 73, no. 2, December 1970, pp. 56-57.**

Summarizes a symposium on transportation noise held at the University of Washington; discusses noise in motor vehicles, the worst offenders, and the cost of making them more quiet; a chart shows statistical distribution of sound pressure levels for various types of vehicles.

235. **Goldwater, B. M., Jr., "Jet Noise – the Problem That Came with Progress",** *Congressional Record,* **v. 117, no. 24, 26 February 1971, pp. E1173-E1174.**

Discusses steps taken by the aviation industry to combat jet aircraft noise, noise lawsuits and complaints, and unreasonable resentment; cautions against overly hasty action to suppress noise; an article by R. J. Serling reprinted from the February issue of *Mainliner.*

POLLUTION – PESTICIDES

236. **Goodling, G. A., "The Economic and Environmental Impact of Pesticides",** *Congressional Record,* **v. 116, no. 205, 19 December 1970, pp. E10557-E10562.**

Includes comments of Dr. R. White-Stevens, chairman of the Bureau of Conservation and Environmental Science, Rutgers University, before the American Farm Bureau Federation; defends pesticides and states that our food supply, health, and living standard are threatened by rash and ill-considered legislation.

237. **"S. 745. – Introduction of the Federal Environmental Pesticide Control Act of 1971",** *Congressional Record,* **v. 117, no. 15, 10 February 1971, pp. S1222-S1228.**

Includes the entire text of the bill (S. 745) to protect the public health and welfare and the environment through improved regulation of pesticides, and for other purposes; introduced by Senator Packwood.

238. **"Administration Drafts Tough Pesticide Bill",** *Chemical and Engineering News,* **v. 49, no. 4, 25 January 1971, p. 24.**

Describes the Nixon Administration's proposed pesticide legislation, which would repeal the Federal Insecticide, Fungicide, and Rodenticide Act and replace it with wider powers of standard-setting and enforcement for the new Environmental Protection Agency.

239. **"DDT: Tougher Laws",** *Chemical and Engineering News,* **v. 49, no. 3, 18 January 1971, p. 9.**

Reports new pesticides legislation and legal actions on DDT and 2,4,5-T are being considered in Washington; a far tougher law will be substituted when the existing federal pesticide law is repealed.

240. **Ehrlich, R. P., and Holdren, J. P., "The Co-Evolutionary Race",** *Saturday Review,* **5 December 1970, p. 66.**

Discusses co-evolutionary systems, such as plants and pests, in which two or more types of organisms evolve in response to changes in one another; agriculturalists are paying more attention to these systems and are using "integrated control" instead of pesticides, which may create new pests by upsetting natural systems of resistance.

241. **"Environmental Implications for Agricultural Aviation – Address by Senator Miller",** ***Congressional Record,*** **v. 116, no. 197, 1 December 1970, pp. S19770-S19772.**

Reprint of a speech by Senator Jack Miller (Iowa) made before a convention of aerial applicators; discusses the importance of agriculture in our environment and the problems of regulating the use of pesticides; recommends that the best scientific and economic research go into solving these complex problems.

POLLUTION – PROBLEMS AND CONTROL

242. **Mezerik, A. G., "A World Irreversibly Committed to Suicide", reprinted in** ***Congressional Record,*** **v. 117, no. 23, 25 February 1971, pp. S2028-S2030.**

The editor of the *International Review Service,* which covers the activities of the United Nations, presents a dramatic description of man's assault on the biosphere with mercury, DDT, and radioactivity, and implies that time is running out before it's too late to salvage the world.

243. **Wise, C. E., "1970: The Year We Began to Design for Survival",** ***Machine Design,*** **v. 42, no. 31, 24 December 1970, pp. 20-25.**

Cites the passage of the National Environmental Policy Act (P.L. 91-190) and the Study of Critical Environmental Problems as two "historical milestones" of 1970; describes over a dozen significant antipollution events around the world in 1970.

244. **Percy, C. H., "The Environmental Dilemma",** ***Congressional Record,*** **v. 117, no. 22, 24 February 1971, pp. S1889-S1891.**

Presents the text of Sen. Percy's keynote address at Georgia Institute of Technology during Technology week, touching on incentives for paying the cost of environmental protection, government regulation, education of the public, technological cures for environmental ills, the need for assessment before action, and the dangers – not to survival – but to the quality of life.

245. **Goldwater, B. M., "Pollution Crusaders",** ***Congressional Record,*** **v. 117, no. 23, 25 February 1971, pp. E1143-E1144.**

Text of Sen. Goldwater's address to the House of Representatives: a series of ordered steps to improve the environment is outlined.

246. **Stuart, P. C., "Counterattack: Pollution, What You Can Do",** ***Congressional Record,*** **v. 117, no. 23, 25 February 1971, pp. E1144-E1146.**

Discusses and lists actions that can be taken by citizens to help relieve the problems of pollution.

247. **Lear, J., "Environment and the Quality of Life – Within the System",** ***Saturday Review,*** **7 November 1970, p. 61.**

Discusses problems connected with working within the (government legal) system with regard to the enforcement of antipollution legislation. Current IRS denial of tax-exempt status to the Natural Resources Defense Council is taken as a case in point.

248. **"U.S., Big Cities Clash on Pollution Order",** *Engineering News Record,* **v. 185, no. 25, 17 December 1970, pp. 11-12.**

Presents briefly the clash between EPA's chief William D. Ruckelshaus and the mayors of three large U.S. cities, Atlanta, Cleveland, and Detroit over notice by EPA that these three cities must cease violating Federal-state water-quality standards within 180 days or face action in Federal courts.

249. *First Annual Environmental Quality Report,* **Hearing before the Committee on Interior and Insular Affairs, U.S. Senate, 91st Congress, Second Session, 13 August 1970, 48 pp. (Available from U.S. Senate, Interior and Insular Affairs Committee, Washington, D.C. 20510.)**

Contains a statement by R. E. Train, chairman, Council on Environmental Quality, concerning the establishment, operation, and plans of the Council and some highlights of the Report; lists actions by 17 Federal agencies in establishing procedures for complying with Section 102(2)(C) of the National Environmental Policy Act; and records Chairman Train's answers to 10 questions by Sen. W. G. Magnuson.

250. **Cohn, V., "Washington vs. Pollution: Blockbuster or Egg?",** *Technology Review,* **v. 73, no. 2, December 1970, pp. 8-9.**

Discusses briefly the legislation and agencies brought into being to tackle the pollution problem: notes the lack of an "ecological research program on the scale needed" to determine what is happening and what to do about it. Presents a list of problems in which no action has been taken.

251. **McKee, E., "The Blunders Companies are Making over Pollution Control",** *Innovation,* **no. 16, November 1970, pp. 24-35.**

Discusses how lack of foresight and failure to do research plague industrial polluters threatened with fines and shutdown for violating pollution standards.

252. **"Agriculture Poses Waste Problems",** *Environmental Science & Technology,* **v. 4, no. 12, December 1970, pp. 1098-1100.**

Discusses the growing problem of agricultural wastes resulting from the increasing intensity of agricultural activities and the contribution of agricultural pollutants (animal wastes, produce-processing wastes, rural domestic wastes, land sediment, plant nutrients and fertilizers, salts and minerals from irrigation, pesticides, aeroallergens and infectious agents, and natural plant emissions) to the growing contamination of the biosphere.

253. **Gray, M. W., "Agriculture and Environmental Pollution",** *Congressional Record,* **v. 116, no. 205, 19 December 1970, pp. E10542-E10544.**

Text of an address given at the annual meeting of the American Farm Bureau Federation, 6-10 December 1970, Houston, Texas. Discusses types and effects of agricultural pollutants on the environment.

254. **"Curbs on Chemicals",** *Chemical & Engineering News,* **v. 49, no. 1, 4 January 1971, p. 13.**

Discusses the need for control of unregulated chemicals and the expected CEQ recommendation for a clearinghouse to be run by the EPA for the registration, screening, and monitoring of all chemical compounds released into the environment.

255. **Hollis, M. D., "Today's Environment", Keynote Address, 21st annual conference of the Florida section of the American Water Works Association and the Florida Pollution Control Association, *Congressional Record,* v. 116, no. 182, 16 November 1970, pp. H10340-H10343.**
Discusses the snowballing pollution problem and calls for reassessment of our approaches, techniques, and levels of commitment to solving the problem; general problems discussed, and examples specific to Florida cited.

256. **Ruckelshaus, W. D., "The City Must be the Teacher of Man", *Congressional Record,* v. 116, no. 199, 11 December 1970, pp. S20042-S20044.**
Reprint of an address made by the new director of the EPA in Atlanta. Atlanta put on 180-day notice for violation of federally approved state water-quality standards; announces also 180-day notices against Detroit and Cleveland; notes that the city dweller bears the heaviest burden of pollution.

257. **"Approach to Anti-Pollution Debated", *Aviation Week & Space Technology*, v. 93, no. 25, 21 December 1970, p. 52.**
Presents the difficulties encountered in attempting to utilize aerospace-industry resources in the field of pollution control. Industrial efforts have been hampered by "inadequate budgets, conflicting jurisdictions, and unclear goals".

POLLUTION – RADIATION

258. **Boffey, P. M., "Radiation Standards: Are the Right People Making Decisions?", *Science*, v. 171, no. 3973, 26 February 1971, pp. 780-783.**
Discusses who sets radiation standards, how they go about doing it, and how adequate the mechanism is; describes the National Council on Radiation Protection and Measurements (NCRP), the International Commission on Radiological Protection (ICRP), and the Federal Radiation Council (FRC).

259. **"Another Round on Radiation", *Science News*, v. 99, no. 5, 30 January 1971, p. 78.**
Calls attention to new recommendations by the National Council on Radiation Protection and Measurements (NCRP) and the controversy between the NCRP and Drs. Gofman and Tamplin, who advocate elimination of the nuclear industry with its radiation hazards.

POLLUTION – SOLID WASTES

260. ***Citizen Support for Solid Waste Management,* Community Action Report SW-17c.1, Chapter 8 in Public Health Service Publication no. 2084, 20 pp. (Available on request from Department of Health, Educa-**

tion, and Welfare, Bureau of Solid Waste Management, 5555 Ridge Ave., Cincinnati, Ohio 45213.)

Points out the need for a sound public information program related to solid waste management, and makes specific recommendations for action by local governments and citizens committees in the area of public relations in connection with implementing, modifying, or operating solid waste management systems.

261. **"Waste Treatment: Spending Boom Ahead",** *Chemical & Engineering News,* **v. 48, no. 53, 21 December 1970, p. 13.**

Presents a brief discussion of the estimated spending over the next 3 years for solid waste management in the U.S. A table presents a breakdown of the total costs according to different processes.

262. **Morton, J., "Can We Use Max Spendlove's Trash Machine?",** *Congressional Record,* **v. 117, no. 5, 27 January 1971, pp. E226-E228 (reprint from 17 January 1971 Sunday Star's Washington magazine).**

Reports on a Federal project currently under way at Edmonston, Md., which is giving substantial support to the concept that solid wastes can be profitably recycled.

263. **Lewin, R., "Who Pays for Plastic Litter?",** *New Scientist and Science Journal",* **v. 49, no. 740, 25 February 1971, pp. 440-441.**

Discusses hazards of plastic litter: degradation of plastic polymers has not been seriously studied, but needs to be in view of the increasing output of plastic materials; presents possibilities for making plastics biodeteriorable.

POLLUTION – WATER

264. **Allee, D. J., and Dworsky, L. B., "Where Now, Clean Water?",** *Congressional Record,* **v. 117, no. 205, 19 December 1970, pp. E10597-E10599 (reprinted from** *Water Spectrum,* **Corps of Engineers, Winter 1970).**

Discussion of the problem of water pollution and the need for action by Drs. Allee and Dworsky, associate director and director, respectively, of the Cornell University Water Resources and Marine Science Center; recommends reassessment and restructuring of waste management and hydrologic planning.

265. **Bazell, R. J., "Water Pollution: Conservationists Criticize New Permit Program",** *Science,* **v. 171, no. 3968, 22 January 1971, pp. 266-268.**

Explains the Administration's recently announced requirement that Federal permits be obtained by all industries discharging wastes into the nation's waterways; discusses its interaction with the 1899 Refuse Act, the Fish and Wildlife Coordination Act, the Federal Water Pollution Control Act, the Justice Department, the Environmental Protection Agency, and state regulatory agencies.

266. **"Waste-Discharge Permits: Harking Back to 1899",** *Science News,* **v. 99, no. 1, 2 January 1971, p. 3.**

Calls attention to and discusses the Executive order to set up a program requiring facilities discharging wastes into rivers and streams in the U.S. to obtain permits from the Army Corps of Engineers, in accordance with the Refuse Act of 1899.

267. **Shen-Miller, J., "Notes After a Conference on Great Lakes Research",** *BioScience,* **v. 20, no. 24, 15 December 1970, pp. 1294-1296.**

Report of the 13th annual conference of the International Association on Great Lakes Research; discusses nutrients, insecticides and chemicals, heat and radionuclides; includes references.

268. **Sheaffer, J. R., "Reviving the Great Lakes",** *Saturday Review,* **7 November 1970, pp. 62-65.**

Describes background research leading to a plan of sewage management to save the Great Lakes. Treated sewage would be piped away from lakes and used to fertilize barren inland fields, resulting in clean water, and fertile, arable land.

269. **"ORSANCO: Pioneer with a New Mission",** *Environmental Science & Technology,* **v. 5, no. 1, January 1971, pp. 22-23.**

Discusses the regional approach to water-pollution control as demonstrated by the 22-year-old pioneer Ohio River Valley Water Sanitation Commission, a regulatory agency with a good achievement record.

270. **Cowden, R. W., "Municipal Problems in Financing Water Pollution Control",** *Journal of Water Pollution Control,* **v. 42, no. 11, November 1970, pp. 1998-2003.**

Discusses financial problems of American cities, and difficulties in funding municipal projects; also discusses relationship of level of taxation and citizen's concern with environment and ecology.

271. **"Balancing the Water Budget",** *Nature,* **v. 228, no. 5278, 26 December 1970, p. 1248.**

Discusses new legislation, effective Sept. 1, 1971, governing water usage and water conservation adopted by the USSR.

POPULATION

272. **Mergen, F. (Ed.),** *Man and His Environment: The Ecological Limits of Optimism,* **Yale University School of Forestry, Bulletin No. 76, 1970, 77 pp. (Available from Yale University School of Forestry, 205 Prospect St., New Haven, Conn. 06511. Price: $2.00.)**

Consists of four lectures by different authors: (1) "How Many People?" (optimum population); (2) "What Level of Life?" (degradation of essential resources with population growth); (3) "Fishes and Loaves" (social origins of environmental problems); and (4) "Freedom and Responsibility: An Environmental Dilemma" (interactions of human ecology with earth ecology).

273. **Brooks, E., "Population v. the Planet",** *New Scientist,* **v. 48, no. 732, 31 December 1970, pp. 586-588.**

Contends that if "the rich countries continue to see economic growth as the **raison d'etre** of human society, then the poor world is hardly likely to avoid being sucked into a process which must inevitably wreck the planet"; expounds on this point and calls for "profoundly different attitudes" in which birth control must be ensured in the rich countries "**because** of economic growth".

274. **Blake, J., "Reproductive Motivation and Population Policy",**

BioScience, v. 21, no. 5, 1 March 1971, pp. 215-220.

Discusses need in all countries for a major revision of policies regarding fertility, if zero population growth is to be achieved through the mechanism of fertility limitation rather than mortality increase; two tables and bibliographical footnotes are included.

PRIORITIES FOR R&D

275. *Priorities in Applied Research, An Initial Appraisal*, **Report of the Committee on Public Engineering Policy of the National Academy of Engineering to the National Science Foundation, 1970, 33 pp. (Available from the National Academy of Engineering, 2101 Constitution Ave. N.W., Washington, D.C. 20418.)**

Includes general recommendations about broad problems of applied research, and specific suggestions relevant to national problems involving the public interest which the NSF might begin to support under its new Congressional mandate.

276. *National Patterns of R&D Resources: Funds & Manpower in the United States, 1953-71*, **National Science Foundation, Report NSF 70-46, December 1970, 38 pp. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: 50 cents.)**

Shows the pattern of utilization of funds and manpower for scientific and engineering R&D among the various sectors of the U.S. economy, including historical trends and relationships; 1971 estimates for total R&D funding are also broken down by basic research, applied research, and development; text and Appendix B contain numerous charts and tables.

277. **Mansfield, E.**, *Industrial Research and Technological Innovation, An Econometric Analysis*, **published for the Cowles Foundation for Research in Economics at Yale University by W. W. Norton & Co., New York, 1968, 235 pp. ($6.00).**

Discusses factors governing rate of technological change, amount of R&D in the U.S., factors governing R&D expenditures, nature of R&D projects, returns from R&D innovations; contains 10 chapters, 5 figures, 47 tables, 3 appendixes, and 169 references; indexed.

278. **Cowen, R. C., "How Elitist Must Responsible Science Be?"**, *Technology Review*, **v. 73, no. 4, February 1971, pp. 6-7.**

A discussion of the issues of "how to establish a truly socially conscious means of setting research priorities; and how to get more awareness of relevant scientific trends into the public decision process", by the London Science Editor of the *Christian Science Monitor*; based on his analyses of pertinent presentations at a conference on "The Social Impact of Modern Biology" held by the British Society for Social Responsibility in Science (BSSRS).

279. **Cohn, V., "Not Like the Olympics"**, *Technology Review*, **v. 73, no. 3, January 1971, pp. 10-11.**

Discusses the threat to U.S. technological superiority as the funding for science continues to decrease. Presents the possibility that U.S. must become second to other nations in some fields and raises questions about which fields will be the ones in which we must take second place.

280. **David, E., "Toward New Initiatives",** *Technology Review,* **v. 73, no. 4, February 1971, pp. 25-27.**

Discusses "relevance" as the fundamental issue of research, and directing research toward the production of new possibilities and capabilities.

281. *Earthquake Hazard Reduction, Program Priorities,* **Report of the Task Force on Earthquake Hazard Reduction, Executive Office of the President, Office of Science and Technology, September 1970, 54 pp. (Available from the U.S. Government Printing Office, Washington, D.C. 20402. Price: 55 cents.)**

Presents a distillation of proposals stemming from numerous studies directed toward defining the best national program leading to the reduction of earthquake hazards; 28 high-priority recommendations are discussed – 13 leading to benefits in less than 5 years, 7 to benefits in 5 to 10 years, and 8 to longer term benefits.

PUERTO RICO

282. **Stevens, C. H., "A State That Listens to Citizens and Science",** *New Scientist and Science Journal,* **v. 49, no. 738, 11 February 1971, pp. 298-300.**

Considers five innovations being introduced in Puerto Rico in order to get government to listen both to science and to the citizen; discusses Governor Ferre's efforts to encourage a peaceful revolution in human understanding in the seventies.

SCIENCE POLICY STUDY ORGANIZATIONS

283. **Harvard University Program on Technology and Society,** *Sixth Annual Report, 1969-1970,* **1 December 1970, 103 pp. (Available from Harvard University Program on Technology and Society, 61 Kirkland St., Cambridge, Mass. 02138. Price: $1.00.)**

Describes the 15 research projects in progress in the areas of Technology and the Individual, Technology and Values, and Impacts of Technology on Economic and Political Organization; includes appendixes covering publications, personnel, teaching activities, and organization.

284. **Center for the Study of Science, Technology and Public Policy,** *Second Annual Report,* **University of Virginia, 30 June 1970, 24 pp. (Available from Mason Willrich, School of Law, University of Virginia, Charlottesville, Va. 22901.)**

Describes policies, organization, functions, funding, and FY 1970 programs of the Center.

285. *SPPSG Newsletter,* **assembled by Howard J. Lewis under the editorial supervision of the Science and Public Policy Studies Group, published monthly by M.I.T. Press. (Address subscription inquiries to The M.I.T. Press, 28 Carleton St., Cambridge, Mass. 02142.)**

Features science policy news, new and current programs and courses, Congressional roundup, other Government publications and announcements, other new publications and announcements, meetings, and personnel changes.

286. **"The Sociology of Technology",** *Nature,* **v. 228, no. 5277, 19 December 1970, p. 1136.**

Reviews and discusses the Harvard Program on Technology and Society.

287. **"Study Characterizes Technology Creators",** *Chemical & Engineering News,* **v. 49, no. 2, 11 January 1971, p. 34.**

Discusses Harvard University Study, Program on Technology and Society, which characterizes individuals who are creating new technology. The study also aimed at developing theory and method of studying social character in the U.S. Results are summarized briefly.

SINGAPORE

288. **Bhathal, R. S., "Science and Government in Singapore",** *Bulletin of the Atomic Scientists,* **v. 27, no. 1, January 1971, pp. 20-21, 38.**

Considers needs of intermediate nations such as Singapore and Malaysia for diversified development programs; discusses aims of science policy in Singapore, the hostility of universities to programs of social engineering or the introduction of applied science, and accomplishments of the new Science Ministry.

SOCIETY-SCIENCE INTERACTION

289. **Lessing, L., "The Senseless War on Science",** *Fortune,* **v. 83, no. 3, March 1971, pp. 88-91, 153-155.**

Criticizes the criticism of science, contending that the resulting reduction in financial support threatens to cripple research and make the U.S. a second-rate nation in technological fields which it had originally pioneered.

290. **"A Time of Torment for Science",** *Science News,* **v. 99, no. 1, 2 January 1971, pp. 5-6.**

Editorializes on the increasing public disillusionment with science and its benefits, as reflected in attitudes at the AAAS meeting.

291. **Rose, H., "Pangloss and the Jeremiah in Science",** *Nature,* **v. 229, no. 5285, 12 February 1971, pp. 459-462.**

Discusses the polarization of public attitudes toward science, especially as reflected in British and American science writing, and raises questions about the "relationship of scientific knowledge to the system that pays for it".

292. **Hadler, P., "Remarks on the Conduct of Science in the Environment of the 1960's",** *Technological Forecasting and Social Change,* **v. 2, no. 2, 1970, pp. 115-123.**

Discusses the need to develop social and technological forecasting to "expand society's options while minimizing penalties for introduction of new technologies". The conduct of science is seen as one of the purposes of our society.

293. **Hovde, F. L., *New Challenges for the Scientific Establishment,* an address before the Indianapolis Scientific and Engineering Foundation, Inc., 22 October 1970. (Reprints available on request from University News Service, Purdue University, South Campus Courts, Lafayette, Ind. 47907.)**

Outlines six new challenges for the scientific establishment: anti-intellectualism, communication, growth of knowledge, population control, human health, and education and training.

294. **George, F. H., *Science and the Crisis in Society,* Wiley-Interscience, New York, 1970, 180 pp. ($4.80).**

Discusses the role that science and technology have played in creating the problems that face our society and in contributing to their solution; chapters deal with basic issues; past, present and future; what science is about; machines, computers and games; cybernetics; the automated society; education; the academic world; the business world; the political world; the emotional world; and society: A.D. 2000 and beyond.

295. **Bendiner, R., "A Word for Science: What Technology Has Done to the Earth, Technology Can Cure", *Congressional Record,* v. 117, no. 19, 19 February 1971, p. E941.**

Includes the text of an article from the *New York Times* of 15 February 1971 which deals with modern needs for technology; regardless of any damages from technology, the cures for our environmental and social ills will be found only with new scientific assistance.

296. **Weinberg, A. M., "The Axiology of Science", *American Scientist,* v. 58, no. 6, November-December 1970, pp. 612-617.**

Discusses axiology of science; i.e., ethics, aesthetics, and theory of value of this branch of the philosophy of science. The question of scientific priorities has given new emphasis to concern with value in science, and "axiology" can provide a framework for scientific administration.

297. **Sheridan, T. B., "Citizen Feedback: New Technology for Social Choice", *Technology Review,* v. 73, no. 3, January 1971, pp. 47-51.**

Discusses ways in which technology may be utilized to aid communication of values among people and help them come to consensus decisions; sets up design principles for a system to help "democratize" the allocation of resources.

298. **Cowan, R. C., "A Science Writer's Advice to Scientists", *Technology Review,* v. 73, no. 2, December 1970, pp. 6-7.**

Advises scientific writers to ignore charges of press irresponsibility in view of the difficulty of assessing "correct" perspective of conflicting statements by scientists. Scientists are also asked to consider the impact of their public statements in this examination of communications problems between scientists and the public.

299. **Krieger, J. H., "Science Priorities and the Inertia They Face", *Chemical & Engineering News,* v. 49, no. 4, 25 January 1971, p. 38.**

Discusses the need for "interaction between the science and non-science communities" to overcome current negative attitudes towards science and to enhance the role of scientist as educator to aid in "an informed democratic process".

300. **Harris, W. J., "On the Convergence of Engineering and Society",** *Technology Review,* **v. 72, no. 9, July/August 1970, pp. 39-41.**
   Discusses the need to promote interaction between engineers and social scientists, and the parallel need to recognize the social consequences of the new technology.

301. **Goodman, D., "Ideology and Ecological Irrationality",** *BioScience,* **v. 20, no. 23, pp. 1247-1252.**
   Discusses in detail the influence of irrational ideologies on present public policy and stresses the need to educate the public and government to the real-world consequences of blind ideology in producing present problems of society, especially as regards the problem of environmental degradation.

302. **Carroll, J. D., "Participatory Technology",** *Science,* **v. 171, no. 3972, 19 February 1971, pp. 647-653.**
   Discusses citizen participation in the public development, use, and regulation of technology; gives five reasons for the emergence of participatory technology in today's society; analyzes three forms: litigation, technology assessment, and ad hoc activity; and discusses questions raised by participatory technology concerning the adequacy of representative government.

303. **Chedd, G., "Scientific Counter Culture",** *New Scientist and Science Journal,* **v. 49, no. 736, 28 January 1971, pp. 174-176.**
   Discusses science as a social activity: disillusionment of younger scientists with a science that does not appear to be concerned with increasing human happiness.

304. **Roszak, T., "Autopsy on Science",** *New Scientist and Science Journal,* **v. 49, no. 742, 11 March 1971, pp. 536-538.**
   Explains the author's indictment that "science has lost faith with itself" (from his book *The Making of a Counter Culture,* to be published by Doubleday), and examines some of the causes for young people dissenting from science.

305. **"Secrecy in Scientific Advising",** *Science News,* **v. 99, no. 3, 16 February 1971, p. 50.**
   Results of a study by Stanford University condemn "excessive" secrecy of scientific advising to the government because it stifles public debate of technological issues.

306. **Thring, M., "A Hippocratic Oath for Applied Scientists",** *New Scientist,* **v. 49, no. 733, 7 January 1971, pp. 25-26.**
   Discusses the moral problems facing the applied scientist and suggests a professional oath to concentrate attention on the responsibility of the applied scientist to judge the ethics of his own work.

307. **Glass, B., "Science: Endless Horizons or Golden Age?",** *Science,* **v. 171, no. 3966, 8 January 1971, pp. 23-29.**
   Discusses two opposing views of science: infinitely expanding knowledge of science versus the finiteness of knowledge of science, and the assumptions on which these two views of man's future are based.

308. *Technology and the Individual,* **Research Review No. 6, Harvard Uni-**

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versity Program on Technology and Society, 1970, 62 pp. (Available from Harvard University Press, 79 Garden St., Cambridge, Mass. 02138. Price: $2.00.)

Contains an introduction discussing problems of freedom, identity, and social integration in a technological society, followed by a liberally annotated bibliography of about 40 references under two headings: Technology, Social Structure, and the Individual; and Technology, Culture, and the Individual.

309. **Carroll, J. D., Higgs, L. D., and Peterson, L. E.,** *Symposia on Science, Technology, and Public Policy in the 1970's, A Synopsis,* **Sponsored jointly by the Division of Public Administration and The Ohio State University Research Foundation, 29-30 October 1970, 34 pp. (Available from Executive Director, The Ohio State University Research Foundation, 1314 Kinnear Rd., Columbus, Ohio 43212.)**

Presents a condensation of the 150 pages of verbatim transcript of the presentations and discussions in the six sessions: Technoscience in the Age of Aquarius; The Quality of Life – Social Astrology and Social Astronomy; Technoscience and Social Problems; Health Policy: The Anatomy of a Myth; Population Policy: Subsidies for Non-Babies?; and Environmental Policy: Who Cares?

310. **Orlans, H., "Social Science Research Policies in the United States",** *Minerva,* **v. 9, no. 1, January 1971, pp. 7-31.**

Discusses historical background, comparison of the status of social science with natural sciences, NSF support, social sciences in the office of the President, national funding, government policy toward social sciences, and functions of social research.

311. **Blumstein, A., Kamrass, M., and Weiss, A. B. (Eds.),** *Systems Analysis for Social Problems,* **Washington Operations Research Council, 5311 Waneta Rd., Washington, D.C. 20016, 331 pp. ($12.60).**

Proceedings of Symposium on Systems Analysis for Social Problems, held May 26-28, 1969, at NBS, Gaithersburg, Md.; covers overview (3 papers), city management (4 papers), human resources development (4 papers), transportation (3 papers), environmental quality (4 papers), and needs in special areas (3 papers); prepared discussions are included.

312. **Cotgrove, S., and Box, S.,** *Science, Industry and Society,* **Studies in the Sociology of Science, Barnes and Noble, Inc., New York, 1970, 211 pp. ($6.50).**

Discusses some of the problems currently being faced by scientists – the influences of industry on the universities, the pros and cons of working in a laboratory, and the gulf between academic and industrial scientists; contains 8 chapters, 3 appendixes, 44 tables; indexed.

313. **Marshall, W. R., "Social Directions of Engineering",** *Chemical Engineering Progress,* **v. 67, no. 1, January 1971, pp. 11-16.**

Discusses the need for interaction of engineering and social sciences in the long-range planning of goals; describes an experimental education program aimed at integrating problems of technology with political, economic, and social decisions.

314. **McElroy, W. D., "Science and the New Spirit",** *Chemical & Engineering News,* **v. 49, no. 4, 25 January 1971, p. 5.**

Discusses the "new" view of science as an instrument for the human progress of society and the principles which should govern this new rationale.

315. **"The Club of Rome",** *La Recherche,* **v. 2, no. 9, February 1971, pp. 110-112.**

    Presents an interview in which Dr. Aurelio Peccei, a founder of the Club, answers questions about the study being conducted on a worldwide basis of the threats of catastrophe posed by growing imbalances on our planet.

316. **Peccei, A., "The Threat to Man is Man Himself",** *Congressional Record,* **v. 117, no. 20, 22 February 1971, pp. S1685-S1686.**

    The founder of the Club of Rome summarizes the problems facing mankind, the quantum jump in technology which challenges the survival of our civilization; to survive, mankind must strive to reach a state of healthy, dynamic stability through balances between man, society and environment; from the *New York Times* of February 18.

317. **Clausen, D. H., "Conservation – for Whom?",** *Congressional Record,* **v. 117, no. 11, 4 February 1971, pp. E493-E495.**

    Includes an address by John A. Zivnuska of the University of California who presents a realistic approach to conservation of natural resources and discusses the need to differentiate between public interest and public enthusiasms.

318. **Von Eckardt, W., "Humanizing the Cities",** *Saturday Review,* **7 November 1970, p. 72.**

    Discusses trends in city architecture based on a current display at the New York Museum of Modern Art showing a new social awareness.

319. **Bowers, R., "Some Views on Physics and Society",** *American Scientist,* **v. 58, no. 6, November-December 1970, pp. 607-611.**

    Some observations on the relevancy of physics to the current social problems of America, together with some comments on American graduate education.

320. *A National Rural Center: Applying Science to Improve the Quality of Rural Life,* **Report of the Study Group on an Institute for Applied Science and Social Change in a Rural Area, Division of Behavioral Sciences, National Research Council, 1970, 51 pp. (Available from National Research Council, Division of Behavioral Sciences, 2101 Constitution Ave. N.W., Washington, D.C. 20418; distribution limited.)**

    Recommends establishment of a public corporation, the National Rural Center, to provide leadership to organize concerted efforts to apply scientific knowledge to "alleviate rural poverty, facilitate rural development, and broaden the technological base of rural society".

321. **"New Role Seen for Industry in Solving U.S. Social Ills",** *Industry Week,* **v. 168, no. 8, 22 February 1971, pp. 20-21.**

    Dr. Simon Ramo, vice-chairman of TRW Inc., thinks the nation has started to turn the corner in curing its social ills; that a powerful new help in the form of a "socioindustrial complex" linking science, government, and industry is on the way.

322. Franke, R. G., "The Biologist, the Psychologist, and the Environmental Crisis", *BioScience,* v. 21, no. 5, 1 March 1971, pp. 221-224.

Advances the theory that although biologists have described the ecological crisis, they do not have the resources to examine the human causes; psychologist Erich Fromm considers environmental problems as symptoms of distress in our society, caused by unmet psychological needs.

323. Hanlon, J., "The Implications of Project Cambridge", *New Scientist and Science Journal,* v. 49, no. 740, 25 February 1971, pp. 421-423.

Discusses the controversy over Project Cambridge, a project to develop computer techniques for behavioral science models, and the military benefit from the research; considers the project potentially highly dangerous because of likelihood of misuse by self-serving politicians and those duped by the computer mystique.

SOIL EROSION

324. *Proceedings of the National Conference on Sediment Control,* Washington, D.C. 14-16 September 1969, May 1970, 54 pp. (Available from U.S. Department of Housing and Urban Development, Office of Metropolitan Planning and Development, Washington, D.C. 20410.)

Contains Sen. J. Randolphs's Keynote Address and nine papers on different aspects of sediment control and regulation.

SPACE – BUDGET

325. Winston, D. C., "NASA Funding Trend Levels", *Aviation Week & Space Technology,* v. 94, no. 5, 1 February 1971, pp. 18-19.

Presents detailed table of NASA Budget plan; FY 1972 budget seen as levelling off next winter; planned expenditures for FY 1972 will be $3.152 billion, a decline of over $200 million from current FY estimates.

326. Winston, D. C., "Viking Mars, Space Shuttle, Nerva Delayed by NASA Budget Slashes", *Aviation Week & Space Technology,* v. 94, no. 6, 8 February 1971, p. 17.

FY 1972 NASA budget confirms slippage in manned and unmanned post-Apollo programs.

SPACE – COMMUNICATIONS SATELLITES

327. Grayson, L. P., "Education Beyond the Horizon", *Science,* v. 170, no. 3965, 25 December 1970, pp. 1376-1382.

Discusses education problems in emerging countries and the promise of satellite-transmitted television, telephone, and computer information for helping to raise literacy levels and communciation abilities.

328. *Communicating by Satellite,* Report of the Twentieth Century Fund Task Force on International Satellite Communications, 1969, 79 pp. (Available from The Twentieth Century Fund, 41 E. 70th St., New York, N.Y. 10021. Price: $1.00.)

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Makes recommendations toward maximizing the potential of satellite communications for serving all mankind; suggests operating procedures for the International Telecommunications Satellite Consortium (INTELSAT) to accomplish this; contains a background paper by P. L. Laskin, who gives a detailed overview of the history, structure, problems, and issues of satellite communications.

329. *The Future of Satellite Communications, Resource Management and the Needs of Nations,* **Second Report of the Twentieth Century Fund Task Force on International Satellite Communications, 1970, 80 pp. (Available from The Twentieth Century Fund, 41 E. 70th St., New York, N.Y. 10021. Price: $1.00.)**

Discusses problems of spectrum resource management in view of the multiplicity of systems offering satellite communication services; emphasizes the need for international planning and coordination; and offers recommendations for resolving conflicts and making satellite communications as widely available as possible.

330. *Planning for a Planet, An International Discussion on the Structure of Satellite Communications,* **Report of an International Conference sponsored by the Carnegie Endowment for International Peace and the Twentieth Century Fund, New York, 1971, 27 pp. (Available from The Twentieth Century Fund, 41 E. 70th St., New York, N.Y. 10021.)**

Presents background and highlights of discussion by 15 participants (each from a different country) centering around three basic aspects of international satellite communications: (1) the capacity of technology and natural resources to meet the world's need for satellite communications; (2) the regulation of telecommunications that cross international boundaries (by the International Telecommunications Union); and (3) Intelsat, the only commercial system that now provides communications satellite services on a global basis.

331. **Browne, S., "Running An International Technology",** *Innovation,* **no. 18, February 1971, pp. 24-31.**

The Director of INTELSAT System Management for the Communications Satellite Corporation (COMSAT) describes in considerable detail the history, nature, scope, and operations of this 77-nation satellite telecommunications network.

332. **Johnsen, K., "Split of Comsat, Terrestrial Carriers Urged",** *Aviation Week & Space Technology,* **v. 94, no. 3, 18 January 1971, p. 18.**

Discusses recommendation by the Justice Department "to make commercial satellite communications competitive with terrestrial modes" by separating COMSAT's ownership and control from that of terrestrial carriers.

333. **"Intelsat Agreement Takes Shape",** *Astronautics & Aeronautics,* **v. 8, no. 12, December 1970, pp. 15-16.**

Outlines tentative recommendations by a working group that met last November to formulate definitive agreements to replace the current interim agreements under which Intelsat (the International Telecommunications Satellite Consortium) has been operating since its inception; about 80 nations are expected to sign at the

Plenipotentiary Conference this spring, though not without opposition from certain countries like France, Sweden, and Switzerland.

334. **"Key Year for European Satellite Communications"**, *New Scientist and Science Journal*, **v. 49, no. 738, 11 February 1971, p. 303.**
Discusses a possible 10-year program under ESRO to set up an operational satellite-communications system to meet European user's requirements for 1980 to 1990, and points out that the European Space Conference will have to decide at its meeting this summer whether to commit itself to the $450 million cost since it would be meaningless for ESRO to continue with a small-budget project.

335. **Redeker, J., "US Volte-Face Over Space Cooperation"**, *New Scientist and Science Journal*, **v. 49, no. 741, 4 March 1971, p. 462.**
Discusses implications of U.S. refusal to aid European nations in the forming of a regional communications satellite network.

SPACE – INTERNATIONAL COOPERATION

336. **Bolkow, L., "A Future for European Aerospace?"**, *New Scientist and Science Journal*, **v. 49, no. 739, 18 February 1971, pp. 352-353.**
Analyzes the conditions under which Europe could unite to create a strong and autonomous cooperative aerospace industry to provide all of its own aircraft and spacecraft; recommends a system-management organization encompassing existing European specialty aerospace firms and a carefully conceived long-term plan.

337. **"Optimism Remains on Post-Apollo Pact Despite Unsuccessful Parley"**, *Aviation Week & Space Technology*, **v. 94, no. 8, 22 February 1971, p. 20.**
Reports on the lack of agreement at a 2-day meeting between a U.S. delegation and a European team from the U.K., France, West Germany, Italy, and Spain, on conditions for U.S.-Europe cooperation on a post-Apollo shuttle system; explains U.S. refusal to grant unconditional guarantee of U.S. launch vehicles for European communications satellites because of possible conflicts with the 77-nation Intelsat operations.

338. **Stubbs, P., "European Space in Pieces"**, *Technology Review*, **v. 73, no. 4, February 1971, p. 14.**
Presents Britain's pragmatic approach to investment in space technology and reviews the complex ramifications of the division of opinion among European countries at the European Space Conference in Brussels last November regarding participation in NASA's post-Apollo program and support of ESRO and of ELDO's Europa III launcher.

339. **"New Man at the Helm"**, *Nature*, **v. 230, no. 5288, 5 March 1971, p. 6.**
Notes election of Dr. Alexander Hocker to post of Director-General of the European Space Research Organization to replace Professor Hermann Bondi, who became scientific adviser to the British Ministry of Defense.

340. **Low, G. M., "International Aspects of Our Space Program"**, *Congressional Record*, **v. 117, no. 5, 27 January 1971, pp. E198-E199.**

Reprint of an address to the National Space Club luncheon. Discusses the possibilities for cooperation in the post-Apollo program; discusses also results of a discussion with a Soviet delegation in Moscow.

341. **"Joint Space Efforts",** *Congressional Record,* **v. 116, no. 197, 9 December 1970, p. H11466.**

Summarizes results of preliminary technical talks between representatives of the USSR Academy of Sciences and the U.S. National Aeronautics and Space Administration on providing for compatible rendevous and docking systems.

SPACE – PROGRAMS AND GOALS

342. *Priorities for Space Research, 1971-80,* **Space Science Board, National Academy of Sciences – National Research Council, 1971. (Available from Printing and Publishing Office, National Academy of Sciences, 2101 Constitution Ave., N.W. 20418. Price: $4.50.)**

Presents a list of recommended projects to be undertaken under the direction of NASA's Office of Space Science and Applications (OSSA) in the next decade, together with the priority NASA should assign to each within its available budget.

343. **Kantrowitz, A., "The Relevance of Space", Address delivered at the seventh annual meeting of the American Institute of Aeronautics and Astronautics, October 1970,** *Congressional Record,* **v. 117, no. 11, 4 February 1971, p. E479.**

Discusses the pessimism about the relevance of space programs to human progress; recommends a space program that will "exhibit that there are no visible limits to man's future in the universe".

344. **von Braun, W., "Man, and Space Exploration",** *Congressional Record,* **v. 117, no. 22, 24 February 1971, pp. E1111-E1114.**

Text of an address given at Texas Christian University; discusses the relation of space activities to the expanding of human knowledge.

345. **Johnson, T., "Science and the Paymasters",** *New Scientist and Science Journal,* **v. 49, no. 737, 4 February 1971, p. 240.**

Discusses and predicts future emphasis in space developments, noting that in the 1980's there will be a rearousal of interest in "near space"; suggestions outline briefly a long-term space exploration program beginning with the space shuttle.

346. **"NASA Cocks Snooks at Academy Advice",** *Nature,* **v. 230, no. 5290, 19 March 1971, pp. 142-143.**

Discusses the National Academy's Space Science Board's recommendations to NASA's Office of Space Science and Applications (Ref. 242) regarding which projects should be undertaken and what their priorities should be; lists some of the suggestions that have thus far been ignored or overruled by NASA and some that have been followed; discusses plans for a Space Program Advisory Council to provide guidance for NASA.

347. **Welsh, E. C., "First Western Space Congress", address given to First Western Space Congress, Santa Maria, California, 28 October 1970,**

Congressional Record, v. 117, no. 199, 11 December 1970, pp. E10352-E10353.

Discusses recent trends in space support and makes suggestions about the direction that space science and technology should take with specific references to space communications, space medicine, and space observations.

348. **"Overlooked Space Program Benefits",** *Aviation Week & Space Technology,* **v. 94, no. 11, 15 March 1971, p. 11.**

Editorial discusses benefits of a national space program, including management benefits, scientific leadership, and space exploration; stresses need of sound technology base for solving national problems.

349. **"Aerospace and the Common Good",** *Aviation Week & Space Technology,* **v. 94, no. 3, 18 January 1971, p. 9.**

Discusses aerospace technology as a significant contributor to the quality of life.

350. **O'Leary, B., "Behind the Scenes at NASA",** *New Scientist and Science Journal,* **v. 49, no. 736, 28 January 1971, pp. 183-185.**

Former astronaut discusses the space program, suggesting deemphasis on manned flight.

351. **Strickland, Z., "Original NASA Goal Re-Emphasized",** *Aviation Week & Space Technology,* **v. 93, no. 23, 7 December 1970, pp. 66-67.**

Discusses comments by NASA's acting director George Low about NASA's role of exploring space to enlarge understanding of the universe and as a means of studying earth problems; states that NASA is not a cure-all for pollution problems arising from unregulated technology.

352. *Venus, Strategy for Exploration,* **Report of a study by the Space Science Board, National Academy of Sciences, June 1970, 79 pp. (Available from Space Science Board, National Academy of Sciences, 2101 Constitution Ave., Washington, D.C. 20418.)**

Describes conclusions and recommendations of a 21-member study group concerning the scientific potential of missions to Venus based on the Explorer technology concept; a substantial effort is recommended for the 1970's and 1980's.

353. **"A Close Look at the Outer Planets",** *Science News,* **v. 99, no. 5, 30 January 1971, pp. 77-78.**

Presents the conflicting views of scientists about the desirability of taking advantage of the rare alignment of Jupiter, Saturn, Uranus, Neptune, and Pluto in 1976-79 to send an instrumented spacecraft on a Grand Tour.

354. **Glass, H. B. (Ed.),** *Life Sciences in Space,* **Report of the Study to Review NASA Life Sciences Programs Convened by the Space Science Board, National Academy of Sciences – National Research Council, 1970, 51 pp. (Available from Space Science Board, National Academy of Sciences, 2101 Constitution Ave., N.W., Washington, D.C. 20418.)**

Presents a series of organizational and scientific recommendations for enhancing the scientific and social significance of the life-sciences aspects of the U.S. space program.

355. *Radiation Protection Guides and Constraints for Space-Mission and Vehicle Design Studies Involving Nuclear Systems,* **Report of the Radiobiological Panel of the Committee on Space Medicine, Space Science Board, National Academy of Sciences – National Research Council, 1970, 79 pp. (Available from NAS/NRC Space Science Board, 2101 Constitution Ave., N.W., Washington, D.C. 20418.)**

Assesses NASA's suggested design criteria and concludes that existing data are not adequate for evaluating risk under space conditions; recommends studies of effects of radiation in combination with other stresses in space.

356. **Moore, P., "The Moon Reconnoitered",** *New Scientist and Science Journal,* **v. 49, no. 736, 28 January 1971, pp. 185-186.**

Discusses use of moon as a scientific base, suggests further need of manned exploration of the moon.

357. **Stubbs, P., "Apollo: A Stocktaking",** *New Scientist and Science Journal,* **v. 49, no. 736, 28 January 1971, pp. 187-189.**

Summarizes some laboratory findings about lunar samples and geophysical observations of the moon, and discusses cost-benefit relationships.

358. **Pardoe, G., "Future Paths in Space",** *New Scientist and Science Journal,* **v. 49, no. 736, 28 January 1971, pp. 189-190.**

Discusses European-American participation in the U.S. post-Apollo program; present position of the U.K. is negative but this position may be reconsidered.

359. **Lewis, R. L., "End of Apollo: End of an Era",** *Bulletin of the Atomic Scientists,* **v. 27, no. 1, January 1971, pp. 26-28.**

The author sees the end of the Apollo Era as the beginning of a new era of cooperation if the post-Apollo program is supported by Congress.

360. **"Space Shuttle", Special A/A Report,** *Astronautics & Aeronautics,* **v. 9, no. 2, February 1971, pp. 22-67.**

Consists of six technical papers by different authors covering various facets of the space shuttle program and technology: "Defining a Giant Step in Space Transportation", "Technology for Aerothermodynamics", "Structures – a Technology Overview", "Dynamics and Aeroelasticity – an Appraisal", "Life Support, Protective Systems, and Crew System Interface Technology", and "The Approach to Propulsion Technology".

361. **"Shuttle Performance Gain Planned",** *Aviation Week & Space Technology,* **v. 94, no. 6, 8 February 1971, p. 16.**

Discusses changes in specifications made to attract military missions; budgets and schedules are included.

362. **"Space Station: Build the Shuttle First",** *Astronautics & Aeronautics,* **v. 9, no. 2, February 1971, pp. 10-12.**

Discusses the role of the space station in future space activities.

363. **Leavitt, W., "The Future of the Space Program . . . Riding on the Reusable Shuttle",** *Air Force Magazine,* **v. 53, no. 12, December 1970, pp. 58-61.**

Discusses the reusable shuttle as the key element in the future of both the space program and the space Agency; shuttle funding seen as critical to having a space program geared to economic payoff.

364. **Strickland, Z., "ERTS Could Aid Crop Blight Fight",** *Aviation Week & Space Technology,* **v. 93, no. 25, 21 December 1970, p. 50.**
Discusses use of earth resources satellite in controlling agricultural blight.

365. **Klass, P., "Remotely Sensed Data Use Spurred",** *Aviation Week & Space Technology,* **v. 93, no. 25, 21 December 1970, pp. 44-45.**
Discusses Earth Satellite Corp. and its role in helping sensor technology for more effective use of data from aerial/satellite imagery.

STATE SCIENCE ACTIVITIES

366. *Research and Development in State Government Agencies, Fiscal Years 1967 & 1968,* **Surveys of Science Resources Series, National Science Foundation, Report NSF 70-22, May 1970, 93 pp. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: $1.00.)**
Presents results of a survey of state agency R&D activities covering expenditures (broken down by state, type of research, functional area, and source of funds); personnel (broken down by functional area and type of personnel); and comparison with Federal and local government R&D activities; text contains 6 tables and 8 charts; there are 4 appendixes with numerous tables.

367. *State Science Activities, Papers and Discussion,* **presented at Workshop on State Science Activities, University Park, Pa., 1 September 1970, 77 pp. (Available from The Pennsylvania State University, Institute for Research on Human Resources, 411 Boucke Bldg., University Park, Pa. 16802.)**
Covers three papers given at the workshop: (1) "State Science Activities: Evaluation and Recommendations", by Irwin Feller; (2) "The Organization of Research Programs within the Commonwealth of Pennsylvania", by Jon P. Nelson; and (3) "State Support of Research and Development as a Method for the Stimulation of Economic Growth", by Irwin Feller and Wesley H. Long.

368. **Feller, I., Nelson, J. P., Friedman, R. S., and Mead, J. M.,** *State Organization of Research and Development: A Case Study, Commonwealth of Pennsylvania,* **December 1970, 254 pp. (Available from The Pennsylvania State University, Institute for Research on Human Resources, Center for the Study of Science Policy, University Park, Pa. 16802. Price: $2.00.)**
Describes and analyzes R&D activities undertaken by departments and agencies of the Commonwealth of Pennsylvania, including administration, budgets, and intergovernmental and university relations; contains numerous tables of expenditures by source and performer for each department or agency.

SWEDEN

369. **Jamison, A., "How Sweden Tackles Pollution",** *New Scientist and*

Science Journal, v. 49, no. 737, 4 February 1971, pp. 234-236.

Describes Sweden's efficient system for dealing with environmental pollution, the 1969 Environment Protection Law which spelled out ways for industry and government to cooperate, technical achievements resulting from basic and applied research, and problems of future development.

TECHNOLOGY ASSESSMENT

370. *A Technology Assessment System for the Executive Branch,* **Report of the National Academy of Public Administration to the Committee on Science and Astronautics, U.S. House of Representatives, July 1970, 85 pp. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: 45 cents.)**

Presents six specific recommendations for carrying out technology assessments; concludes that effective technology assessment must permeate the decision-making process of the Executive Departments and Agencies and that the Council on Environmental Quality should, with backing from the Office of Management and Budget, have central responsibility for Government-wide policy, coordination, and review of technology assessment.

371. **LaPorte, T. R., "The Context of Technology Assessment: A Changing Perspective for Public Organization",** *Public Administration Review,* **v. 31, no. 1, January/February 1971, pp. 63-73.**

Explores the consequences of the fundamental political and cultural changes brought about by technological development, and proposes expanded and much more difficult criteria for the systems analysis of technological development.

372. **Katz, M., "The Function of Tort Liability in Technology Assessment",** *Cincinnati Law Review,* **v. 38, no. 4, Fall 1969, pp. 587-662. (Available on request as Reprint No. 9 from the Harvard University Program on Technology and Society, 61 Kirkland St., Cambridge, Mass. 02138.)**

Examines the implications of certain doctrines and theories of tort liability for technology assessment, and the reciprocal implications of technology assessment for the tort theories and doctrines; explores the examples of oil pollution from offshore drilling accidents and noise pollution from the SST.

373. **Price, R., "Technology Assessment",** *Congressional Record,* **v. 117, no. 7, 29 January 1971, pp. E278-E279.**

Proposes that an Office of Technology Assessment be established in order to guide science and technology in directions that are consistent with the public and national interest.

374. **Livingston, D., "International Technology Assessment and the United Nations System",** *The American Journal of International Law,* **v. 64, no. 4, September 1970, pp. 163-172. (Reprints available from Dennis Livingston, Interdisciplinary Studies, Crawford Hall, Case Western Reserve University, University Circle, Cleveland, Ohio 44106.)**

Defines and elaborates on the technology-assessment concept, justifies its application on an international scale, and formulates a model of a United Nations-connected assessment mechanism.

375. **Miller, G. A., "Assessment of Psychotechnology",** *American Psychologist,* **v. 25, no. 11, November 1970, pp. 991-1001.**

A code of priorities for psychotechnology assessment is presented to help provide a basis for evaluating the effects and implications of research and technology, that is, the social and psychological consequences of technology.

376. **Kasper, R. G.,** *Some Comments on Technology Assessment and the Environment,* **paper presented at a panel discussion on "What to do About the Environment", 19 November 1970, Program of Policy Studies in Science and Technology, The George Washington University, Occasional Paper No. 8, 16 pp. (Available from National Technical Information Service, Springfield, Va. 22151. Price: $3.00.)**

Explores the relationship between technology assessment and environmental problems and calls attention to difficulties stemming from the tendency to take a narrow technological view of broad social problems, the tendency to consider the environment as a static entity, and roadblocks to effective implementation of results of technology assessments.

377. **Budowski, G., "The Quantity-Quality Relationship in Environmental Management",** *Impact of Science on Society,* **v. 20, no. 3, July-September 1970, pp. 235-246.**

Points out that responding to increasing human needs by increasing the volume and size of goods, services, structures, and institutions has caused extensive damage to the world, and that deterioration progresses pretty far before the public starts clamoring for quality too; cites examples of actual projects representing poor and good planning for quality in environmental management.

378. **Carpenter, R. A., "The Political Use of Ecological Information",** *BioScience,* **v. 20, no. 24, 15 December 1970, p. 1285.**

Discusses technology assessment, the characteristics of the Federal Government assessment process, the need for ecological information to be fed into decision making as quickly as possible, and opportunity for ecologists as detailed in the National Environmental Policy Act.

379. **"Technology Assessment: Management, Manpower and Methodologies", 1971 Engineering Foundation Conference,** *Engineering Foundation Newsletter,* **16 February 1971.**

Announces a conference to be held at Proctor Academy, Andover, N.H., Aug. 30-Sept. 3, to exchange information on current assessment efforts, to stimulate new research on assessment and its management, and to promote the use of quantitative techniques; details available from the Engineering Foundation, 345 E. 47th St., New York, N.Y. 10017.

TRANSPORTATION

380. **"Transport Agency",** *Aviation Week & Space Technology,* **v. 94, no. 8, 22 February 1971, p. 13.**

Discusses the recommendation by the Advisory Council on Executive Organization that the three existing transportation regulatory agencies (CAB, ICC, and FMC) be abolished and their functions be consolidated in a new agency.

381. **Shapley, D., "R&D Conversion: Former NASA Lab Now Working on Transportation",** *Science,* **v. 171, no. 3968, 22 January 1971, pp. 268-269.**
Describes the closing of NASA's Electronics Research Center in Cambridge, Mass., in June 1969, even before it was completed and fully staffed; discusses its takeover as a transportation research center by the DOT, with the conversion of 450 electronics specialists to transportation-oriented research.

382. **"New Office Established by FAA to Play Key Role in Research",** *Aviation Week & Space Technology,* **v. 94, no. 2, 11 January 1971, p. 20.**
Announces the creation of a new Office of Systems Engineering Management in the Federal Aviation Administration to direct the FAA's greatly expanded R&D effort in such areas as radar beacon systems, landing systems, navigation systems, runways and taxiways, oceanic traffic control, enroute traffic control, and airborne systems; discusses some of these projects and the possible role of the DOT's Transportation Systems Center (Ref. 381).

383. **"Subsonic Transport for 1980's",** *Science News,* **v. 98, no. 26, 26 December 1970, p. 478.**
Describes NASA's proposal to develop an advanced transport to fly just below the speed of sound to meet the demands of the 1980's and stay competitive in the world's aviation market while avoiding SST headaches.

384. **Swihart, J. M., "The Promise of the Supersonics", AIAA Paper 70-1217, presented at the 7th Annual Meeting and Technical Display, Houston, Texas, 19-22 October 1970, 7 pp. (Reprints available at photocopy prices from Technical Information Service, 750 3rd Ave., New York, N.Y. 10017.)**
Presents a case for the development of the SST; discusses the economics of present and future SST's, along with the evolution in the total system.

385. *The Supersonic Transport, Fantasy and Fact,* **Aerospace Industries Association, February 1971, 9 pp. (Available on request from Aerospace Industries Association of America, Inc., 1725 DeSales St. N.W., Washington, D.C. 20036.)**
Offers refuting information on arguments used against continuation of development of the U.S. SST, under such headings as Productivity, Government Investment, Return on Costs, National Priorities, Balance of Trade, Noise, Sonic Boom and Radiation, Pollution, and Jobs and Dollars.

386. **Gilluly, R. H., "How to Move People in the Cities",** *Science News,* **v. 98, no. 25, 19 December 1970, pp. 464-465.**
Describes various systems for mass transit in and around cities, and gives their pros and cons.

387. **"The YOPHU's and the Millions",** *Technology Review,* **v. 73, no. 2, December 1970, pp. 55-56.**

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Brief presentation of how the Urban Mass Transportation Administration (UMTA) plans to spend the $80 million available to it next year under the newly signed transit bill; plans include reinforcing some present transit systems and research and funding for new demonstration systems.

UNITED KINGDOM

388. **"Time for a New Look",** *Nature,* **v. 229, no. 5279, 1 January 1971, pp. 1-2.**
Reports a thorough examination will be carried out by the Council for Scientific Policy into the British government's machinery for scientific research; discusses possible reorganization of civil research.

389. **"More Marking Time",** *Nature,* **v. 229, no. 5284, 5 February 1971, pp. 360-361.**
Discusses the British budget for scientific research, criteria for deciding how much to spend, and the support that the research councils and universities can expect in the future.

390. **"Cuts in Public Expenditure Hit Civil Research",** *Nature,* **v. 229, no. 5284, 5 February 1971, p. 364.**
Because the British government has decided to reduce public expenditure, a decline in the growth rate of the budgets of the research councils will take place; 2 tables illustrate expenditures by the research councils and proposed expenditures on education.

391. **Hamilton, D., "What Next for the RAs?",** *New Scientists and Science Journal,* **v. 49, no. 736, 28 January 1971, p. 192-193.**
Outlines the changing role of Britain's research associations, their links with industry, their problems and possible future.

392. **Bowden, Lord, "Science in Crisis",** *New Scientist and Science Journal,* **v. 49, no. 735, 21 January 1971, p. 127.**
Discusses the question of who shall decide on the distribution of Great Britain's limited national resources, and the role played by British universities in facing fundamental social and philosophical problems of a science-oriented civilization.

393. **Gray, J.A.B., "Role of the Research Councils",** *Nature,* **v. 230, no. 5288, 5 March 1971, pp. 23-25.**
The secretary of the British Medical Research Council defines the problems facing the research councils in Britain, discussing his own council in particular, and draws some personal conclusions about future needs in the administration of science in the U.K.

394. **"Government Survey Raises Unemployment Spectre",** *Nature,* **v. 230, no. 5289, 12 March 1971, pp. 72-73.**
Interprets the results of a U.K. survey, "Persons With Qualifications in Engineering, Technology, and Science, 1959-1968" (HMSO, £2.25); notes that unemployment is becoming an increasing cause for concern among qualified scientists and engineers in England.

395. **"Select Committee Probes Embarrassing Area",** *Nature,* **v. 229, no. 5286, 19 February 1971, p. 519.**

Reports findings of a subcommittee of the Select Committee on Science and Technology which has held public hearings on British space research policy; discusses activities of the Ministry of Aviation Supply, including development of the Black Arrow Launcher.

396. **"Space Policy: Goods Without Prices",** *Nature,* **v. 230, no. 5289, 12 March 1971, p. 74.**

Describes the recommendations made by the British Aircraft Corp. to the U.K. Select Committee on Science and Technology, calling for a national satellite for direct television broadcasting, participation in the U.S. post-Apollo program, and pursuit of international applications satellite programs; gives reasons why the British government is likely to reject these, including the fact that the price tags are not well defined.

397. **"No Space Policy",** *Nature,* **v. 229, no. 5284, 5 February 1971, p. 362.**

States that the Ministry of Aviation Supply does not have complete control over the development of Britain's space research policy; discusses responsibilities for space activities; includes a table on U.K. expenditure.

398. **Johnson, T., "Science and the Paymasters",** *New Scientist and Science Journal,* **v. 49, no. 735, 21 January 1971, p. 128.**

Discusses the Atomic Energy Authority Bill, which will create two new corporations — British Nuclear Fuels and the Radiochemical Centre — out of the commercial side of the AEA and empower the government to sell shares in the corporations to private investors.

399. **"Nuclear Hazards and the Citizen",** *New Scientist,* **v. 49, no. 733, 7 January 1971, p. 4.**

Calls upon the nuclear industry to "seek actively the fullest possible public participation in nuclear decisions and to consider seriously the objections of all responsible critics"; presents highlights of the British Radiological Protection Act of 1970, under which the National Radiological Protection Board was created.

400. **"Electricity Not to Order",** *Nature,* **v. 228, no. 5277, 19 December 1970, pp. 1125-1126.**

Describes problems faced by the British power industry stemming from outages running up to 20% of total capacity last winter, corrosion in the early nuclear plants, a wage dispute between the Board and plant workers, and discrepancies between today's actual and predicted fuel and energy needs.

401. **Shepherd, E. C., "A Shrinking Aircraft Industry",** *New Scientist,* **v. 48, no. 729, 10 December 1970, p. 437.**

Discusses the future of the British aircraft industry; Britain no longer has a place in the airliner market since abandonment of the BAC 3-11.

402. **"CERN Accelerator: Scrutiny and Secrecy",** *Nature,* **v. 230, no. 5290, 19 March 1971, p. 139.**

Describes the various viewpoints expressed at a meeting organized by the British Society for Social Responsibility in Science to discuss the decision of the British government to participate in the CERN 300 GeV accelerator project; at issue was the scientific-decision-making process, rather than the merits of the program.

403. **"Social Irresponsibility in Science",** *Nature,* **v. 229, no. 5286, 19 February 1971, p. 153.**
Terms the efforts of the British Society for Social Responsibility in Science as so far not being conspicuously successful; discusses its lack of a formal relationship with the British Association.

404. **"Computers, Conservatives and Governments",** *Nature,* **v. 230, no. 5288, 5 March 1971, pp. 1-2.**
Points out that the policy of the new Conservative government in Britain seems to be not to use the apparatus of public intervention in industry which the Labor government set up; it has taken away from the largest computer manufacturer the sense of sponsored security it has enjoyed since its formation; compares the cases of ICC and Rolls-Royce; questions how this policy can encourage desirable technical development.

U. S. SCIENCE POLICY

405. **"Science Policy? Never",** *Technology Review,* **v. 73, no. 2, December 1970, p. 62.**
A reprise of comments by Raymond Bowers, director of the Cornell Program on Science, Technology, and Society on the difficulties of formulating national science policy.

406. **Vohra, H. R., "Science in Congress",** *Bulletin of the Atomic Scientists,* **v. 27, no. 2, February 1971, pp. 44-46.**
A review of the involvement of Congress in science policy, and current thinking on science policy as reflected by the House Subcommittee on Science, Research, and Development together with some observations on pluralistic support of science and technology by the Government.

407. **"Sweetness and Light Break Out Again",** *Nature,* **v. 230. no. 5288, 5 March 1971, pp. 8-9.**
Discusses the science policy making machinery in Washington, which the article claims is now running without disharmony; reports on speeches made by the President's Science Adviser, Dr. Edward E. David on behalf of the SST and on science policy, and by Congressman Edward P. Boland, Chairman of the House Appropriations Committee, at a seminar on science and public policy, held at the National Academy of Sciences from February 22 to 24.

408. **"Push On To Set Science Policy",** *Industrial Research,* **v. 12, no. 12, December 1971, p. 31.**
Discusses coming executive and legislative task of setting forth a formalized national science policy and current approaches to the problem being considered.

409. **Fling, K. J., "Congressional Science Hearings: Money Talks",** *BioScience,* **v. 20, no. 23, 1 December 1970, pp. 1267-1269, 1274.**

Gives an overall view of issues discussed at the hearings before Daddario's House Subcommittee on Science, Research, and Development which were held from 7 July to 17 Sept. 1970 as a fact-finding mission to determine the feasibility and desirability of formulating a national science policy; scientists made it clear that a formal science policy should be avoided – the present omnidirectional mode should be continued.

410. **Ayres, R. U., "We May Be Losing Our Technological Lead", *Innovation,* no. 17, January 1971, pp. 12-19.**
Discusses the necessity of maintaining technological lead if the U.S.'s high standard of living is to be maintained; offers suggestions for new government R&D spending policies to support invention and innovative technology.

411. **"More Favor for Applied Science", *Science News,* v. 99, no. 3, 16 January 1971, p. 44.**
Briefly reviews the need for a national science policy in the U.S. and interprets remarks made in January by presidential science adviser Edward E. David, Jr. to staff and guests of National Bureau of Standards concerning ground rules for setting science policy and organizing Federal science.

412. **"Presidential Report", *Chemical & Engineering News,* v. 49, no. 6, 8 February 1971, p. 35.**
President Nixon has asked his science advisor Edward David to submit by May the first version of an annual report on science and technology, which will probably be passed on to Congress and the nation; termed "the first attempt by the Executive Branch to blueprint our national R&D priorities".

U.S.S.R.

413. **White, S., "Not Fishers of Men", *New Scientist,* v. 48, no. 729, 10 December 1970, pp. 449-450.**
Reviews writings of Alexander Solzhenitsyn, Nobel prize winner for literature, who, with a scientific background, writes on the scientist's relation to his work and the responsibility this incurs, and reveals much of life in the USSR.

414. **Gvishiani, D., "Research in the Soviet Union" (in French), *La Recherche,* v. 2, no. 8, January 1971, pp. 9-11.**
An interview in which one of USSR's top research managers discusses the Soviet approach to effective management of science and technology.

415. **"Decline in Science Expenditure", *Nature,* v. 228, no. 5277, 19 December 1970, pp. 1130-1131.**
The State budget of the Soviet Union for 1971 reflects a policy of increasing investment in industry but some decline in the rate of growth of spending on science and education; figures are given; and the five-year plan for 1971-75 is mentioned.

416. **"Soviet-Style Science in Eastern Europe", *New Scientist and Science Journal,* v. 49, no. 738, 11 February 1971, p. 304.**

Describes how the organization of research and development in the USSR and most Eastern European countries has changed from a strongly centralized system in the 1950's to a more diffuse organization designed to encourage the initiative and efficiency needed in highly industrialized countries; from an article by Jan Osers in *Wirtschaft und Wissenschaft* (No. 6, 1970).

417. **Shelton, W. R., "Science in Siberia",** *Bulletin of the Atomic Scientists,* **v. 27, no. 2, February 1971, pp. 23-28.**
Relates impressions the author received when he toured Soviet science centers; discusses the improved status and working environment of Russian scientists, their international prestige, and their encouragement of international cooperation; illustrations are given from lives of several scientists.

418. **"Siberia Coming in from the Cold",** *New Scientist,* **v. 48, no. 730, 10 December 1970, p. 441.**
Gives recommendations from a symposium on developing Siberia and the Far East; these included processing of raw materials on the spot; development of various industries, and consuming finished products in the same eastern regions.

419. **"New Science Centre",** *Nature,* **v. 229, no. 5279, 1 January 1971, p. 4.**
Reports formation of a Far Eastern Science Centre of the Academy of Sciences of the USSR from existing scientific institutions in the Soviet Far East.

420. **Low, G. M., "Comparison of Apollo and Luna", Letter to Rep. George Miller,** *Congressional Record,* **v. 116, no. 192, 2 December 1970, pp. E9998-E9999.**
Discusses Soviet space flights to the moon and compares Soviet and U.S. capabilities.

421. **White, S., "Pravda's Space Predictions",** *New Scientist and Science Journal,* **v. 49, no. 735, 21 January 1971, p. 101.**
Discusses a Pravda editorial in which Soviet space achievements in the past year were reviewed and a statement made that "long-operating orbital space stations" will soon be launched.

422. **"How the USSR Plans to Develop Its Ocean Resources",** *Ocean Industry,* **v. 5, no. 12, December 1970, pp. 25-26.**
Describes the Soviet Union's detailed plan to develop her available ocean resources; topics include: the controlled marine economy program, deep-water engineering facilities, submarine drilling, subsea communications, and research to prolong divers' underwater stay.

WEATHER MODIFICATION

423. **"Snowfall, Ecology and Man",** *Science News,* **v. 98, no. 24, 12 December 1970, p. 447.**
Enumerates the 13 studies to be carried out by three Colorado universities under an $881,000, 4-year grant from the Department of the Interior to study the ecological effects of the increased snowpack resulting from a planned program of seeding winter

clouds over the San Juan mountains to increase the spring and summer water flow.

424. *Project Skywater '70,* **The Bureau of Reclamation's Program of Atmospheric Water Resources Management, U.S. Department of the Interior, Bureau of Reclamation, Descriptive pamphlet, 1970. (This and other literature on conservation and reclamation available on request from Bureau of Reclamation, Engineering and Research Center, Building 67, Denver Federal Center, Denver, Colo. 80225.)**

Discusses the initiation, goals, ongoing efforts, and plans of Project Skywater — a research effort to learn how to manage precipitation in water-deficient areas by cloud seeding in an efficient, economic, and socially acceptable manner.

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